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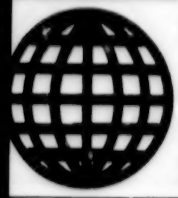

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JPRS Report

Science & Technology

Central Eurasia

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JPRS-UST-94-008 31 March 1994

CONTENTS

CHEMICAL INDUSTRY

MISCELLANEOUS

MATERIALS SCIENCE

ANALYSIS, TREATMENT, MINING

METALS

PHYSICS AND MATHEMATICS

COMPUTERS

ELECTRONICS

TELECOMMUNICATIONS

ENGINEERING AND EQUIPMENT

NUCLEAR AND NON-NUCLEAR ENERGY

MECHANICS OF GASES,LIQUIDS AND SOLIDS

EARTH SCIENCES

LIFE SCIENCES

AGRICULTURAL SCIENCE

BIOTECHNOLOGY

EPIDEMIOLOGY, MICROBIOLOGY,AND VIROLOGY

MEDICINE AND PUBLIC HEALTH

PHARMACOLOGY AND PHYSIOLOGY

LASER AND NONIONIZING RADIATION

Round Table Discusses Problems of Russian Science

Saltykov Emphasizes Accomplishments

947A0031A Moscow ROSSIYSKAYA GAZETA in Russian 18 Feb 94 p 3

[Article by Yuriy Konorov: "Will There Be Any Newtons for Us?"]

[Text] A round table has been held in the Ministry of Science and Technology Policy.

In opening the discussion, Head Minister Boris Saltykov stressed that the basic goal of State policy in the area of science and engineering is to retain the best part of the scientific-technical potential of Russia under conditions of economic collapse.

Boris Saltykov bitterly noted that all last year, due to the lack of adequate funding, scientists had to think about holding on to science rather than development.

However, we managed to do quite a bit even under these difficult conditions. Forty one State scientific-technical programs were set up and put into operation. Proposals have been prepared on implementing 117 priority technologies and new kinds of goods within the scope of State structural policy. Funding has been obtained for 33 State science centers, which has enabled retention of leading science schools in the high-tech field.

As one of the foremost among the republics of the former Soviet Union, Russia has been first to enter as a full-fledged member into the European technological program "Eureka." An intergovernmental agreement has been concluded on scientific-technical cooperation with the United States. International scientific-technical cooperation of Russia has enabled continuation of many research projects in the field of high-energy physics, the human genome and genetic engineering, and promising information technologies.

However, the speakers noted that the situation in science and technology is getting tenser. As before, science is being funded by the month, and by leftovers. For example, last year science organizations were underfunded by about 300 billion rubles.

Numbers of science personnel are also diminishing, both because of the outflow of scientists to the private sector, and because of the "brain drain" abroad. The best people are leaving. The prestige of work in science has waned, there is a reduction in the percentage of graduates from institutions of higher education that train science personnel, schools of science and whole disciplines are breaking up.

There has been a sharp reduction in volume of agreements between enterprises and science organizations, the construction of science projects has been curtailed, unique structures are falling into disrepair. The breaking of ties between organizations of the former Soviet republics is having an enormous detrimental impact on the development of science.

Lack of cash is decelerating and downscaling international cooperation.

Difficulties in State Financing Discussed

947A0031B Moscow SEGODNYA in Russian 17 Feb 94 p 9

[Article by Roman Vershillo: "Russian Science: To Strangle or Not to Strangle? There Won't be Any More Broad Research Front"]

[Text] Minister Boris Saltykov warned journalists gathered at the round table in the Ministry of Science and Technology Policy that the subject was going to be mainly about money, or rather about the lack of it. As should have been expected, last year the Ministry of Finance came up 300 billion rubles short, which is 30 percent of the total budgetary expenditures for science. In January and February of 1994, totals of 27 percent and 40 percent respectively were allocated.

Saltykov caused a sensation by stating that the space program had been 148 percent financed. Aircraft builders also got a surplus. "And for all that, the general 'science' budget was not increased by a single copeck," said the Minister. "The chosen ones thus got some of the money of "disowned" fields." As it turns out, the mysterious reason for this situation is that last autumn Prime Minister Chernomyrdin visited "Energiya" Scientific Production Association. The Prime Minister confronted Saltykov: "Why didn't you tell me before that such remarkable specialists are working there?"

"The Russian Government cannot afford to support a broad research front," maintains Boris Saltykov. As an alternative to the Soviet course, where ambitious projects were carried out at the expense of the entire society, the Ministry of Science has put forth a program of priorities.

Among these are production technologies, information science and communications, development of new materials, power engineering, transportation, life sciences and genetic engineering, ecology, space, research on fundamental problems of the social and cultural development of Russia, and also research on the fundamental properties of matter. Thirty three State Science Centers have been set up to deal with these areas. Of course, all science institutions of Russia are making efforts to get into State Science Centers. The Ministry of Science has received more than 200 applications. As implied by Saltykov's words, the State Science Centers are not entirely maintained by the State. Funding will be granted only to specific scientific developments that have passed muster by experts within the walls of the ministry.

Among the other problems that have beset Russian science, mention was made of the exodus of skilled personnel out of the country, and also to the private sector. Vladimir Mikhaylin, chairman of the Union of Scientific Societies of Russia, has pointed out that there has been a drastic decline in the number of scientists in the 30-40 year age bracket.

Saltykov gives assurances that he is doing everything possible to keep the powers that be from strangling our science. But he admitted that scientists do not have the capability of turning off a valve, like people in the oil industry, or cutting off coal shipments, like the miners. So the minister is pretty sure that it would do no good for scientists to go on strike.

Energy Crisis Closes Ukrainian S&T Institutes

947A0030B Kiev PRAVDA UKRAINY in Russian 3 Feb 94 p 3

[Interview with Ukrainian Academy of Sciences Corresponding Member Anatoliy Shpak, academy chief scientific secretary, by Dmitriy Kiyanskiy; place and date of interview not given: "What is Happening With the Academy? For the Government's Information: If the Most Urgent Steps Aren't Taken, Serious Science May Soon be Nonexistent in Ukraine"]

[Text] Two doctors of sciences complaining of general weakness, fast tiring and noise in their ears visited the Kiev hospital servicing scientists almost simultaneously. An examination revealed that both of the elderly gentlemen were suffering from anemia with, of all things, chronic undernourishment as the cause.

Recently I needed an old friend in an urgent matter—a division director in a certain academy institute. I phoned him at work, but there was no answer. An hour later, the same result. When I dialed his home, I heard the voice of my friend.

"What's the matter," I asked, "you sick?"

"No," he said. "Luckily I'm healthy, but like with all of my colleagues I'm now working as a scientist at home. The institute building isn't heated, and we were let out until spring."

Here's another fact. It was reported in the Presidium of the Ukrainian Academy of Sciences that the issue of reorganizing a number of scientific research institutes in connection with their inability to work under the new conditions is now on the agenda.

Yes, something isn't right in the kingdom of science. And judging from everything, the disease won't be cured with mustard plasters, berry tea, and lime blossoms. Medicines of higher efficacy are needed.

What is happening with the Academy of Sciences, which just recently stood on one of the top rungs of the social hierarchical ladder? Can something really be jeopardizing the existence of such a mighty and reliable structure? A PRAVDA UKRAINY correspondent discusses these questions with ANU [Ukrainian Academy of Sciences] Corresponding Member Anatoliy Shpak, the academy's chief scientific secretary.

Kiyanskiy: What adjustments has the current energy crisis made in the activity of ANU institutions? After all, while historians, economists, philologists or theoretical physicists could work a few months at home when their institutes run out of money for heating, such a routine is

not suited to experimental physicists, chemists, materials scientists, and representatives of many other scientific disciplines.

Shpak: To our great regret scientists in the humanities aren't the only ones who have to work at home. Our institutions are hundreds of millions of rubles in debt for heat and electric power, and a large number of scientific research institutes in the technical and natural sciences must switch to such a strange work routine, encountered nowhere else in the world. Thus, the temperature in the laboratories and offices of the institutes of colloidal chemistry and water chemistry, microbiology and virology, and molecular biology and genetics has been reduced to plus five degrees Celsius, and the scientists are forced to work at home. I'm afraid that such a "routine" will last until May-June.

One extremely typical example could be cited here. The allotment of electricity to the Institute imeni Paton was reduced by a fourth. Strange, isn't it? Electric welding without electric power! Even our children are affected by the economic woes. Academy day care centers have closed down for a month (and perhaps more!): There's no money to keep them going.

Kiyanskiy: So what happened? Why has science transformed so quickly into a Cinderella? For what reason has it been put on starvation rations? Have the government bigwigs really decided to rectify the country's catastrophic financial situation at the expense of scientists, as if it's impossible to find any other means of avoiding economic ruin?

Shpak: That seems to be the case. Judge for yourself: Current financing, and all the more so the prospects for this entire year, are totally inadequate to even our most minimal needs. This pertains chiefly to fundamental research, without which the existence of civilized society is altogether impossible. And all the more so in a country that only recently embarked upon the path of independence.

As of today the state owes the academy 40 billion karbovantsy, and this is with regard for the sharply higher prices of fuel. The institutes are presently spending a third of their allocated funds on wages, while practically all the rest goes to energy resources. Our institutions spend hardly any money to obtain modern scientific equipment. And without it, it's altogether impossible to obtain results of any value. What are we here for, if not for that?

Recently Ukrainian scientists have been unable to maintain contacts with their own colleagues in the far and near frontier. There's no money for business trips. But why even talk about foreign countries!? It's a problem today just to travel to another city in Ukraine for a conference. The institutes have stopped subscribing to foreign scientific periodicals. And everyone knows, after all, that an information vacuum is contraindicated to science.

I know that the fuel situation in Ukraine is totally stressed, but economization and the economy are two different things. To deprive the academy of the needed minimum of energy resources actually means sapping the life blood of entire directions. The research equipment of the leading scientific centers consumes a rather large amount of energy—you can't do anything about that. Consider just the Institute of Nuclear Research. This is a huge complex of unique devices for experimentation in physics, including a nuclear reactor and accelerators. Two-thirds of the academy's associates work in such energy-intensive scientific institutions. It is precisely in such institutes that the country's intellectual potential is created.

Kiyanskiy: Just 5 years ago the wages of scientists evoked the unconcealed envy of all other Soviet workers. A doctor of science in charge of a division or a laboratory received 500 rubles, and felt himself to be extremely well-off. How much are scientific workers paid today?

Shpak: Before 1 December of last year a doctor of sciences received from 220,000 to 290,000 karbovantsy, a candidate of sciences received an average of not more than 200,000, and a scientific research institute director (as a rule a prominent scientist and a member of the academy) received 370,000 karbovantsy—almost as much as a taxi driver earned. An academician was paid a little more for his high scientific title—10,000 coupons, while a corresponding member was paid 5,000. This amount was enough for one and a half chicken eggs.

The pay of scientists was tripled in December, but this is on the average. In general, to be honest, pay is different in different scientific institutions: No special subsidies were allocated to the academy. The institutes are facing a dilemma: pay for building space, or increase wages. Many are trying to find the golden mean. As a result it comes both hot and cold for them, as they say. Such that now even a yardman doesn't envy a doctor of sciences.

Some of my acquaintances—people with academic degrees and the highest qualifications—are forced to become taxi drivers for several hours in the morning before work and in the evenings, using their own cars. What choice do they have? Life is making them do it! You can't feed a large family today on scientific activity alone.

I can't help worrying when I look at some of our old academicians—prominent scientists who devoted the best years of their lives to science, and who now have to keep a mental tally of how much they spent today on a carton of milk and a can of sour cream, and of how many coupons are left over for tomorrow. The old academician goes to the store, and all he gets is grief: His paltry pension and academy benefits aren't enough for the most necessary things.

Need we be amazed that some scientists have decided to leave the country? Unfortunately the most energetic, promising and talented are the ones who are leaving: Young people have no faith in advancement, and in

making a career of it in their homeland, they have no certainty in tomorrow. Even venerable scientists are now emigrating. Many of our former compatriots can be found in the West's leading scientific centers, though unfortunately, not only as professors.

Kiyanskiy: How many scientists has the country already lost?

Shpak: In the last two and a half years over 300 persons left institutes of the Ukrainian Academy of Sciences for business trips abroad for a period of over 6 months. Unfortunately one out of every three has not returned. We don't know what many of the scientists who left will do. The terms of their business trips aren't up yet. However, more than likely our institutes will not be seeing some of them anymore.

By the way, "internal emigration" is no less dangerous. Both young academy scientists and middle-aged people are leaving more frequently for commercial organizations. Science is losing prestige literally before our eyes.

The Ukrainian Academy of Sciences is certainly experiencing one of the most difficult periods of its life. The situation in the institutes is now extremely complex, and to be honest, the spirits of their colleagues are rather low. It is already clear today, after all, that a large number of our scientific institutions will encounter very serious difficulties this year, and even the question of their very existence will possibly be raised.

In all probability, representatives of government structures arguing for ultraeconomical and clearly insufficient financial support to Ukrainian science believe that in the extreme case it could be mothballed until better times. But can it? Of course it wouldn't be difficult to literally freeze places like the institutes of cybernetics or molecular biology and genetics: Their colleagues work in cold offices anyway. But can you really freeze cybernetics, molecular biology, and other disciplines until better times? In 5-8 years they will fall hopelessly behind, and this will retard the entire state's intellectual development.

Russian Ministry of Science Reform Program Debated

947A0030A Moscow POISK in Russian No. 1 (243), 7-20 Jan 94 p 5

Anatomy of a Conflict

[Text] The presidential edict on the structure of federal bodies of executive government was awaited impatiently by workers of the Minnauka [Ministry of Science, Higher Education and Technology Policy], but they weren't alone. Will the ministry remain a ministry? This question troubled all who found themselves in the zone of "combat activities" between the RAN [Russian Academy of Sciences] Presidium and the leadership of the Minnauka. Military terminology is certainly apropos in this situation—what other than a retaliatory blow can we call the December resolution of the RAN Presidium expressing the desire to lower the status of the Minnauka to a state committee? This was a response to the government's desire to cut the funding of the RAN. It was at the Minnauka, as the structure that would implement this policy, that the Presidium vented its wrath.

Each of the opposing sides has its own interests, which they feel agree with state interests. And each could quite soundly prove its righteousness. RAN leaders believe that all functions of fundamental sciences in the academy must be preserved. But the opinion of the government is that the state budget is unable to maintain the RAN in the form in which it now exists, and that priorities have to be chosen. This is what is at the root of the conflict. But as we can see, the forms of the struggle are arbitrary.

The ministry has remained a ministry. More than that, the RF Committee on Information was placed within its structure by an edict signed by President B. Yeltsin. The above-cited resolution of the RAN Presidium evoked differing assessments from the academic milieu. Some institute directors supported it completely: A letter to President B. Yeltsin written on the instructions of the Conference of Directors of Academy Institutions of the Moscow Region is published on this page. Extracts from letters from other Moscow directors expressing disagreement with some provisions of the resolution, particularly regarding the Minnauka, are presented here as well. Academicians of the Siberian Department of the RAN also expressed trust in the ministry. We decided to acquaint you with these letters, because they reflect not only the concrete situation but also a vision of how science is to live in the future.

Priority to the Priorities

A group of directors of the largest institutes wrote a letter to Russian Federation President B. Yeltsin in connection with adoption of a resolution by the RAN Presidium on 14 December 1993 on financing the RAN and on matters relating to administration of science. The letter's authors agree with the provision of the resolution noting the insufficiency of basic financing of scientific institutes both in and outside the RAN system.

However, they believe the resolution errs when it suggests reorganizing the RF Ministry of Science and Technology Policy as the RF State Committee for Science and Technology, and focusing its activity on the problems of organizing, shaping, and monitoring fulfillment of scientific and technical programs.

In the opinion of the undersigned, institutes engaging in fundamental science must receive basic financing at least at the minimum level in order to preserve scientific potential, but under the conditions of the difficult economic situation, priority should be given to the principle of competitive financing of science. In the last two years the RF Ministry of Science and Technology Policy began implementing this principle systematically, and it enjoyed certain success on this path: Scientific collectives that achieve the greatest successes and possess the

best foundation for research in the most promising direction receive priority financing through the Minnauka.

The authors of the letter feel this policy of the Minnauka to be correct in principle, and they support it. The departmental principle of financing science proposed by the RAN Presidium, according to which money is distributed among the institutes by departmental leadership (in the Academy of Sciences by the RAN Presidium) is deleterious to science—it will result in the uniform impoverishment and demise of all science in Russia.

Therefore in the opinion of the letter's authors the suggestion by the RAN Presidium to fundamentally reorganize the Minnauka and sharply reduce the competitive principle will lead us on the wrong path, and is totally unacceptable.

The letter was signed by RAN Academician S. Belyayev, director of the Institute of General and Nuclear Physics of the Russian Kurchatovskiy Institute Scientific Center; RAN Academician L. Keldysh, director of the Physics Institutes of the Academy of Sciences imeni P. Lebedev; Professor A. Simonov, director of the Scientific Research Physicochemical Institute imeni L. Karpov; and others, nine persons in all.

What's the Use of Recommendations?

A message from Siberian scientists to Prime Minister V. Chernomyrdin signed by academicians V. Koptyug, D. Knorre, D. Derevyanko, A. Skrinskiy, V. Titov and V. Shumnyy, and RAN corresponding members K. Svitashev, Yu. Shokin and V. Kuleshov notes that far from all activity of the Minnauka has been supported by the scientific community. But they feel that "elimination of a government body at the highest level responsible for 'meshing together' the efforts of scientific collectives of different departments and integrating them in the solution of the most important problems of science and applied science threatens destruction of state scientific and technical policy. And this harbors very grave losses for the country. Replacement of a responsible government body by an advisory one will not save the situation under today's conditions. The unity of state scientific and technical policy would be lost."

Are These the Forms the Reform is Supposed to Take?

Now that hopeful signs of political stabilization have appeared following adoption of the new Constitution and election of the Federal Assembly, and sensible correction of the course of the reforms currently under way is planned, we, the scientists of Russia, find it necessary to state our position regarding processes occurring in Russia and in Russian science, without the apprehension that our opinion might be used to incite passions and disturb equilibrium in the society.

The Russian intelligentsia was one of the main driving forces of the reforms and democratic transformations. It was among the first to understand the deleteriousness of the economy's extensive development in the former USSR, having indicated the existence of a direct correlation between quality of life and the need for converting the economy to new technologies created by science. The turn in socio-economic relations to the freedom of creativity, to the freedom of entrepreneurship for the good of Russians is the strategic direction of the reforms that attracted the scientific and technical intelligentsia.

But the real results of the reforms are far from what was anticipated. A great country has been transformed before our eyes into a helpless organism.

Scientific discoveries and new technologies that even before were introduced into production with difficulty are now simply unwanted. How can we discuss application of new technologies when vitally important enterprises are being shut down, and industrial investments are becoming purely symbolic?

Financing of Russian science has diminished to dangerous levels. The especially grave consequences of this manifested themselves in fundamental research. Its situation is presently deteriorating from critical to catastrophic. Scientific observations providing for prompt notification regarding natural disasters (tsunamis and earthquakes for example) are coming to a halt, the work of world-renowned scientific centers is being terminated, and research on the most important state programs is being abandoned.

Scientists are being forced to leave the institutes that have been their homes, and go abroad or join commercial organizations in search of a better share. Young replacements are not going into science. Scientific conferences, materials and reagents, scientific literature, and experimental devices have become luxuries beyond reach.

Science is an integrated living organism, and it does not tolerate interruptions in its growth and development. Any delay in this development may cause Russia to fall many decades and generations behind the world cultural and technological level, and the country to fall back to secondary scientific positions.

It has long been established that world science is indivisible. Russian science is a recognized component of it. The demise of Russian science cannot but have consequences, and it will be detrimental to all world science. This understanding of the role of Russian science is precisely one of the main motivating factors behind the assistance being provided to it from without. However, no assistance can replace providing for the normal vital activities of science. Only the state can accomplish this task.

While we are totally grateful to those who are sincerely helping Russian science in its hour of need, we cannot ignore the fact that Russia is sending abroad, in mass numbers and free of charge, highly qualified scientists and specialists whose selection and training require a great deal of time and significant outlays. The losses to

the CIS countries by the end of the 1990's from intellectual emigration, calculated by United Nations procedures, will be tens of millions of dollars annually.

Basic state budget financing of fundamental research, scientific schools, and the principle of accessibility of the sphere of science to every citizen of the country, regardless of class membership, are the principal mechanisms by which vital and creative energy flows into Russian science. These mechanisms were developed over the course of centuries, and they have demonstrated their practical effectiveness. Now they are being destroyed.

Appropriation of budgetary assets to science by the state is one of the forms of long-range investment. Investing assets into science is economically advantageous, and it is a practice followed by all developed countries.

Even in the extremely difficult years of the Great Patriotic War and postwar devastation, the country found the possibility to provide real support to its science, and use the results of scientific research and development for constructive purposes.

Today, however, a strange kind of deformation has occurred in the society's perception of science and of the labor of scientists. The authority of academy science has been undermined, and its importance to the life of the country is being glossed over.

Despite the edicts of the Russian president "On Creation of the Russian Academy of Sciences" and "On Material Support to Russian Scientists," which raised the hopes of the scientific community, economization of budgetary expenditures on fundamental research continues. Can we really have any serious hope of rectifying the state of affairs with the state budget by reducing and postponing essentially negligible payments to science? It doesn't take more than 0.5 percent of the country's budget to support the entire Russian Academy of Sciences for a single year, after all, at the same time that when practical use is made of the results of scientific developments, they return hundreds of billions, if not trillions, of rubles.

There is one other subject about which we are deeply concerned: the appearance of information in the mass media on plans for restructuring science that would jeopardize the very existence of the RAN. Democratic transformations must not lead to the destruction of the Russian scientific school, the traditions of which ascend from the era of Peter the Great.

The path to normalization of relations between government and science lies through recognition of their interdependence. Russian science will perish without government support, but after that, not only rebirth of a democratic Russian state but even its survival in the modern science-intensive world will be impossible.

We believe that the existing creative potential of Russian scientists must be mobilized to lead the country out of its crisis.

We will support reforms directed at improving the living conditions of the majority of Russians, and at freedom of the creativity of the individual, at the flourishing of science, and at modernization of production on the basis of modern high technology and honest entrepreneurship for the good of every inhabitant of Russia.

Scientists are ready to take part in developing the course and program of the reforms, and in implementing them. We can make a contribution to the Russian economy's rebirth. We have created materials with unique properties, developed energy and resource conserving procedures, new information technologies, bioengineering, the means of protecting and restoring the environment, of conserving and making sensible use of biological resources, and of obtaining energy, new medical preparations and medical equipment, and many other things.

Finding themselves together with most Russians in a difficult material position, Russian scientists are not fighting for outlandish wages, although in civilized countries the status of the scientist presupposes a worthy material reward. Russian scientists demand just one thing today—the possibility for working productively in their country, and in their professional sphere—science.

It stands to reason that we clearly recognize the need for improving the forms of work of both Russian science as a whole and of its nucleus—the Russian Academy of Sciences. But we, the scientists, must do this ourselves, and in such a way as to preserve the best historically evolved traits of Russian science as a phenomenon of worldwide cultural importance.

Believing the issues discussed here to be exceptionally important to development of the positive directions of transformations in Russia, we appeal to you to meet personally with the leading Russian scientists at the soonest possible moment convenient to you.

In behalf and on the instruction of directors of academy institutes of the Moscow Region: RAN Academician Yu. Gulyayev, Academician G. Arbatov, Academician Yu. Zolotov, Academician N. Lyakishev, Corresponding Member Yu. Altukhov.

Saltykov on Russian S&T Priorities

947A0036A Moscow ROSSIYSKIYE VESTI in Russian 3 Mar 94 p 13

[Article by Boris Saltykov (prepared for publication by Vladimir Khrustov); "Approaches Change, Priorities Remain: Boris Saltykov, RF Minister of Science and Technical Policy, on Priorities in State Scientific and Technical Policy"]

[Text] In the present day socio-economic situation we have been forced to lay aside our former approaches when research was carried out on a broad front in all directions of world science. Today, due to the shortage of funds, this is impossible. However, the acute problem

arises, under conditions of economic decline, of preserving the best part of the scientific and technical potential of Russia and at the same time adapting it to the requirements of a market economy. Accordingly, the priorities in the development of science and technology are clearly defined. First and foremost among these are production technologies and new materials, information science and communications, power engineering and transportation, biology, ecology, and space.

We are seemingly implementing the priority policy at three levels. The first is state scientific and technical programs. Forty-one such programs have been drawn up and implemented, within whose framework 117 priority technologies and new types of production will be introduced.

In addition, priorities have been defined among scientific institutions. These are what we today call state scientific centers. This is the second level.

After the entire old (ministerial) control system had collapsed, the branch scientific research institutes found themselves in a most difficult situation, especially those in the defense sector. The danger appeared of their complete loss due to the fact that the ordinary sources of funding had disappeared.

Today 33 state scientific centers are therefore being funded, these including 55 organizations and enterprises, which is making it possible to preserve key national scientific schools in the high technologies field. These include the group of aviation centers headed by the Central Aerohydrodynamics Institute, five nuclear groups headed by the Kurchatov Institute, shipbuilding, electronics, chemical, and other groups.

Finally, there are priorities at the level of small research bodies and laboratories, which, in academic science, for example, has been realized through the Fundamental Research Fund, already established in 1992. Reference is to the development of new organizational forms of innovative activity: business incubators, industrial parks, etc. For this purpose a special decree of the government has established a fund which is designated for support of small entrepreneurship in the scientific and technical field, also including the financial field. Most importantly—promising projects with a heavy scientific orientation have been initiated.

However, the situation in the scientific and technical sphere is deteriorating. Science, as before, is being funded on the residual principal: during 1993 the funding of civilian scientific research and experimental-design work was only 72.9% of the planned annual amount; scientific organizations thus did not receive about 300 billion rubles.

It is true that in the "scientific budget" proper there are some interesting "internal" peculiarities. To be sure, everyone has suffered. But they have lacked to an unequal degree. The academic-university sector received approximately 82% of the planned sums and the Russian Academy of Sciences a little more than 84% and its departments also received different percentages. Far Eastern—88%, Ural—81%. Incidentally, here there is some confusion which sometimes bursts onto the pages of newspapers: why does the Ministry of Science and Technical Policy not give the Academy of Sciences money? The fact is that the Russian Academy of Sciences (and also the Academies of Medical or Agricultural Sciences) has its own item in the federal budget and receives money independently.

What is true is that the Ministry of Science and Technical Policy is funding only priority scientific and technical fields. The most important of these are state scientific and technical programs, international and regional projects. We also have a program for assistance to the innovative sphere: business incubators, commercial and industrial insurance policies, industrial parks, of which there already are about 30. This program today is being separated off into a separate program and we have succeeded in creating (as I have said, a government decree has already been issued) a special individual fund which will support this program, assist inventors and new structures to get on their feet and to turn projects into realities. However, our ministry has received only 59% of the planned funding.

Who are the favorites? The space program: it has been allocated 148% of that planned by the budget. I do not regard such a situation to be entirely normal. Unfortunately, it is now not impossible that space also will soon experience the negative consequences of such a policy. Because if we no not develop electronics, chemistry, and new construction materials which are "stagnating" under other programs, after 3-5 years we will exhaust the substantial advances which today are working for the space program. Accordingly, corrections are unquestionably necessary here.

Such disproportions cannot but be reflected in the fates of scientists and specialists. The trend of a continuous reduction in the scientific work force, beginning in 1991, also is persisting in 1993, and at rates outpacing the numbers in the economy. The prestige of scientific work has fallen. Including because of the low wages, which in November 1993 were 38% below the average for the economy. The percentage of university graduates linking their career to scientific work is declining. Thus, not only the personnel potential of Russian science is decreasing, but also the possibilities of its reproduction. The "brain drain" problem has grown appreciably worse.

As indicated by the beginning of the year, the situation not only is not improving, but instead is worsening. And this is related to a considerable degree to energy prices. After they had "retreated" in the autumn, they rose sharply and by the end of the year many scientific centers had suffered seriously. For example, the High-Energy Physics Institute at Protvino, where the accelerator for just one session (and that for 2-3 weeks) requires so much power that the bill is in the billions. There are a

great many other power-hungry enterprises, especially those in the chemical industry.

In general, the situation is as follows: whereas earlier the expenditures for power were 7-10% of the budget, at a number of institutes they have now risen to 60% or more. Since no improvements are foreseen here, we have raised the question of a reduction of electric power rates for budgeted organizations. As well as on the indexing of expenditures on goods and materials. Because today the situation has taken on a near-catastrophic character: we pay little more than a meager wage, we light and heat facilities, and that's it. There is no money for carrying out scientific research (instruments, equipment, reagents, etc.).

Meanwhile January-February showed: from the Ministry of Finance we received from 27 to 40% of the planned amount. The situation with funding, I repeat, not only has not stabilized, but also continues to deteriorate.

However, despite the difficult situation in the country, the scientific and technical potential of Russia remains extremely strong. Many of our country's research and development projects are not simply competitive in the West, but sometimes are above and beyond the world level. Russia retains parity in such fields as power engineering, new materials, chemical technologies, genetics, and others.

It is a shame that the existing achievements are being put to practical use slowly. For example, up to 30-40% of the development work of scientific organizations in the agricultural field are finding no application at all in production and the genetic potential of varieties and hybrids of agricultural crops and breeds of animals is being used no more than 60%.

And what do we see as our principal goals in the immediate future? An individual item was introduced in the budget for a program for maintaining the largest national instruments—telescopes, experimental reactors, etc. This "forces" institutes to use this expensive equipment for its intended purpose.

We intend to shift the emphasis from the macro- to the micro-level. Several funds have been established for broadening the possibilities of choosing funding sources for scientific institutions and scientific workers. Today we are convinced that the principal problem is the micro-level: it is necessary to decide what to do within a scientific institution under the prevailing conditions.

One of the methods for implementing the priorities is a changeover to a contract hiring system. The principal obstacle is the archaic and conservative Labor Law Code. But meanwhile precisely a contract will make it possible to pay people for their work, not for the job which they fill.

The second acute problem: what in general to do with the network of scientific institutions? Today there is a clear-cut answer: categorically refuse to support from the budget those scientific structures, those scientific organizations which are unneeded by the state. The state must support fundamental science, which, incidentally, is by no means the case in all countries. It developed in Russia, it is our national tradition, it must be preserved, and we are doing everything possible for this. We will be able to maintain activity in a number of fund-hungry fields only, as we say, in a "monitoring mode." This is necessary in order to keep an eye on the world level, and if, speaking figuratively, a "supernova" flares up, if some promising research field takes form, we can immediately jump in on its development, there could be "nuclei" on the basis of which new creative teams could be organized. But we acknowledge that the maintenance of all fields at the state level is today unrealistic.

We also will insist on such an aspect as keeping in contact with industry. We will develop a program for state scientific centers. Today, as I already mentioned, we are funding 33, and another 217 are standing "in line." Some of them are entirely worthy of support, but we cannot include in this pool more than a score of new centers. We also will strive to establish a State Fund for Research in the Humanities.

Bauman Institute to Receive State Scientific Center Status

947A0033B Moscow ROSSIYSKIYE VESTI in Russian 1 Mar 94 p 8

[Article by Vladimir Khrustov; "Bauman Probably Will Become a State Scientific Center"]

[Text] It is desirable that a State Scientific Center be established on the basis of the famed Moscow State Technical University [formerly the Moscow Higher Technical School] imeni N. E. Bauman. That is the unanimous conclusion reached by participants in a joint session of the boards of the Ministry of Science and Technical Policy and the State Committee for Higher Education of Russia. This was a field session which was held at the Bauman Institute because it examined the problem of use of the scientific potential of the oldest technical school of higher education in the country.

The Bauman Institute—today a technical university—needs no special introduction: almost all the creators of aviation and rocket-space technology have graduated from its walls. But not many probably know that the Central Aerohydrodynamics Institute, Moscow Aviation Institute and Moscow Systems Research Institute (as well as many other institutions of higher education) are "daughter" enterprises of the Bauman Institute.

Today the technical university is experiencing difficult times. A sharp reduction in budgeted financing and orders for scientific research development work (during the last 3-4 years orders have decreased by a factor of 4-6) urgently dictate that additional measures be taken for preserving the scientific potential of the university, its scientific schools and the material-technical base. Incidentally, the latter by many criteria is unique. This

applies, in particular, to the academic-experimental center of the university in Dmitrovskiy Rayon of the capital region, which in essence has today become a scientific city.

The understanding that a further lag in the development of science and education is fraught with irretrievable losses for society is today determining, as was noted by Igor Fedorov, academician ANS, rector of the Moscow State Technical University, in a conversation with a ROSSIYSKIYE VESTI correspondent, the principal directions in the development of scientific research in the university and its activity as a whole.

The guests were shown an exhibit displaying the latest development work by the scientists and specialists of the Bauman Institute. Among the new materials and technologies, instruments and machines there are more than a few which are unique. For example, a robotized complex, better than its foreign analogues, has proven its worth in work on elimination of the consequences of the accident at the Chernobyl nuclear power plant.

State S&T Information System (GSNTI) Lacking Policy, Funding

947A0033A Moscow SEGODNYA in Russian 3 Mar 94 p 9

[Article by Rudzhero Gilyarevskiy, Lyudvig Korotkevich and Arkadiy Chernyy: "Still Another Strategic Resource. On the Doorstep: A System for Using Technical Information"]

[Text] With respect to coverage of the fields of science and technology, economic branches and regions, the USSR State System for Scientific and Technical Information (GSNTI) had no precedents in world practice. The centralization of the processing of the principal types of scientific and technical documents made it possible to avoid multiple duplication in the purchase and intellectual processing of literature, especially foreign literature and to reduce expenditures by branch and territorial systems substantially.

However, the declared objective of exhaustive coverage of the world scientific and technical literature was never attained. About 1,500 of the most important foreign periodicals were not received in the country and the transactions of important scientific conferences, foreign reports and dissertations were received only from time to time.

Now many of the information centers constituting parts of the USSR GSNTI are suffering a pitiful existence. The bonds among them have been weakened or completely broken. The purchases of foreign scientific and technical literature have been sharply reduced. The Russian State Library does not receive and therefore is unable to make many national periodicals available to readers.

The Ministry of Science and Technical Policy of the Russian Federation (RF) is trying to maintain "fragments" of the USSR GSNTI, by tradition more or less uniformly distributing crumbs from the state budget among them.

Meanwhile commercialization is strongly intruding in the activity of the scientific and technical information (STI) services. For example, the State Public Scientific-Technical Library of Russia has already introduced pay for servicing of enterprises and organizations with literature on interlibrary loan, although its funds come exclusively from the state budget. Thus, there is actual privatization of that which has already been paid for completely by the taxpayers.

A decree of the RF government, No. 16, dated 6 January 1993, strengthening the strictly centralized management of the territorial STI centers in the republics, krays and the oblasts of the RF, was a questionable attempt at reanimating a part of the USSR GSNTI. The structures whose principal objective not long ago was the servicing of the oblast and kray committees of the CPSU, are continuing to be controlled from Moscow without participation of the governments of the republics and local administrations, be it in Yekaterinburg, Kazan or Yakutsk. Among the great variety of problems to be dealt with the first one was by far not the most important and it was solved in the spirit of the old traditions.

It must be stated that there is no clear concept with respect to the organization and development of a STI system in the Russian Federation either in the government or in the Ministry of Science and Technical Policy.

What should be the state policy of the RF in the STI field in order to ensure the most complete and efficient use of the information resources available in the country and beyond its borders?

In the process of changeover to a market economy in the RF the appearance of private (including commercial) STI centers also was inevitable. However, there should be complete or partial (50-60%) state financing of STI centers and scientific-technical libraries servicing economic sectors vitally important for the country but not yielding a direct profit.

It is necessary to embody in the law and realistically ensure the right of each citizen-taxpayer to free access to any information: socio-political, scientific, technical, commercial and other, collected or created using the resources of the state budget. Payment can be levied only for additional services with an added cost for covering the actual expenditures for rendering these services, but without receiving a profit.

The reliability of an information servicing system is predetermined primarily by the completeness of coverage and routineness in processing of the world flow of STI. The most effective means here is the centralization of collection, systematization, referencing and indexing of all the scientific and technical information appearing

in the world. It is important to guarantee the receipt in the country, at least in a single copy, of all publications which may be of interest for Russian scientists and specialists.

Databases (DB), usually constituting electronic versions of printed publications, that is, newspapers, journals, encyclopedias, reference books, etc., are becoming an increasingly more important type of STI sources. In 1992 throughout the world there were more than six thousand generally accessible DB with an annual increase in their number by more than 20%. However, there is not even one well-developed country which can be completely reliant on the physical or electronic supply (importation) of foreign DB because this would put it in increasing dependence on the supplying countries.

The STI system also must include a service for the rapid preparation and delivery of copies of original sources to readers. In order to meet the needs for information with minimum expenditures it is necessary to have integrated information systems: they are based on the one-time processing of STI sources and the input of the corresponding data into a computer with their subsequent repeated use.

A matter of concern of countries should be the supply of information to small and intermediate enterprises and companies. Since such enterprises are usually incapable of maintaining their own STI services, the state must ensure the preparation of the information which they require and favorable conditions for acquiring it.

An increase in the information literacy of scientists and specialists also is becoming an important prerequisite for the efficient use of STI.

Taking into account what has been said, it appears that the STI system in the RF must be organized in the following way. The state, public and private STI centers, scientific-technical publishing houses, libraries, intermediary and consultation companies should form the national network of STI agencies. The STI centers, libraries and other information structures servicing spheres vitally important for the country and therefore financed from the state subject should be combined into a State STI System (GSNTI RF) whose operations are organized on a nonprofit basis.

The GSNTI RF should include the following principal types of information agencies: STI functional institutes and centers, carrying out the most complete possible collection of publications and unpublished documents, their intellectual processing, preparation of DB and information publications (in electronic or printed form) and their dissemination, thematic STI centers whose principal function would be the selective dissemination and retrospective subject-thematic information and document search—predominantly in a remote dialogue access mode—on the basis of use of DB made available by licenses or acquired from those organizing them, a center for the routine issuance of copies, a translation center and "brain centers": administratively independent scientific research organizations, preparing under special order predictions of development, analytic reviews and summaries.

The territorial STI centers, scientific-technical libraries in the republics making up the RF, and also in the krays and oblasts, must be established, maintained and controlled by the governments of these republics, the authorities in the krays and oblasts.

The Ministry of Science and Technical Policy of the Russian Federation can be seen as the principal coordinator of development and implementation of state policy in the STI field. It could rely on an interdepartmental STI committee.

CHEMISTRY

Surface State of Film-Type TiO_2-Electrodes, Modified With Silver Particles

947M0027B Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol. 67, No. 12, Dec 93 pp 2442-2446

[Article by V. S. Gurin, V. P. Poroshkov, K. N. Kasparov, Ye. A. Tyavlovskaya, and N. I. Kuntsevich, Physico-Chemical Problems SRI; Belorussian State University, Minsk; UDC541.138:543.022]

[Abstract] The known possibility of selective chemical and electrochemical deposition of metals on surface films of titanium dioxide from aqueous solutions containing the corresponding metals is governed by the fact that the deposition process rate, both chemical and electrochemical, increases markedly on those portions of the surface modified with metallic particles (Ag, Pd, Ni, and others). At 10^{14} - 10^{16} atoms per cm^2 silver content, it becomes possible to realize selective electrochemical deposition of a metal phase onto modified portions of the film. In this case, the rate of electrochemical deposition on them is 10 or more times greater than that on film portions not containing silver. The properties of microheterogeneous systems of the oxide-metal particle type, in which the oxide acts as a carrier, largely depend on the specifics of particle-carrier interaction. An important role is also played by the oxygen adsorbed from the atmosphere on the surface of a semiconductor and on the metal particles. In the case of the system TiO_2-Ag particles, the selectivity of the electrochemical deposition process, as manifested in changes in the process kinetics and a drop in overvoltage in comparison with deposition on TiO_2 films not containing silver, may be due to special features in the interaction between the silver particles and the TiO_2 film. Previous research concerned mainly the electro- and photoelectro-chemical characteristics of the system, and the status of silver on the TiO_2 surface remained unclear. In the present work these properties of silver particles in a Ag-TiO_2 system were studied employing electochemical methods, electron microscopy, and X-ray photoelectron spectroscopy. At 10^{14}-10^{16} atoms per cm^2 silver concentration on the surface, the presence of 5-100 nm sized silver particles was confirmed, and a marked a marked interaction between the silver and the TiO_2 surface was observed. Figures 3; references 20: 10 Russian, 10 Western.

Conditions for Thermodynamic Stability of Superconductor $YBa_2Cu_3O_{6+z}$

947M0027A Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol. 67, No. 12, Dec 93 pp 2393-2398

[Article by S. A. Degtyaryev and G. F. Voronin, Moscow State University imeni M. V. Lomonosov; UDC541.11]

[Abstract] The electro-physical properties of high temperature superconductors, as observed at low temperatures, are determined by the conditions under which they were prepared at high temperatures, and for this reason study of phase equilibria and stability over a wide range of temperatures and oxygen partial pressures is of primary importance to the preparation of ceramic materials and films having good working characteristics. The notion of determining the area of thermodynamic stability of a substance comes down to the fact that any unforeseen changes in properties are excluded at equilibrium in this area; by fixing the thermodynamic variables, thermodynamics guarantees preservation of the state of equilibrium and also determines the trend and final result for any given changes in the system. The title phase (123), as well as others, may, and in fact does exist beyond the limits of the stated thermodynamic equilibrium range of temperature, pressure, and composition. This can only be metastable or frozen (labile) states of matter. In the first case the state may exist indefinitely, so long as no sources of activation energy, necessary for transition to stable equilibrium, enter the system. In a previous work, the thermodynamic stability of the 123 solid solution was determined on the basis of the results of a thermodynamic study of the system Y-Ba-Cu-O. In the present work the most recent data on the thermodynamic properties of this phase were used to calculate stable and metastable phase equilibria within the title system. The area of thermodynamic stability of this phase was constructed for the coordinates composition-temperature and partial oxygen pressure-temperature. The results were compared with existing published results of direct experimental research and the thermodynamic properties of Y_2BaCuO_5 and the solid solution $YBa_4Cu_3O_{8.5+q}$ were estimated. Figures 2; references 39: 7 Russian, 32 Western.

Surface-Layer Sorbents Based on Molecular Sieves, Their Use for Fast Analysis of Carbon and Nitrogen Oxides

947M0033E Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol. 67 No. 10, Oct 93 pp 2059-2061

[Article by V.G. Berezkin, V.F. Tretyakov, Ye.Yu. Sorokina, Zh.R. Tuzhilina, and A.Sh. Mamedov, Petrochemical Synthesis Institute imeni A.V. Topchiyev, Russian Academy of Sciences, Moscow; UDC 543.544]

[Abstract] Specimens of surface-layer sorbents (fractions of 0.16 to 0.22 mm) were prepared based on chromosorb G-AW, inerton AW, and Celite-545 with molecular sieves of the type NaX, NaY, and Na-mordenite and a crystal size of 1 to 10 μm. The content of active adsorbent on the surface of each surface-layer sorbent ranged from 20 to 50 percent of the solid carrier's weight. An LKhM-8MD gas chromatograph with a heat conduction detector was used for the studies; helium or hydrogen served as the carrier gas. A stainless steel column was filled by means of a vacuum pump and conditioned at 300°C for 3 hours. The height equivalent to a theoretical plate, column capacity coefficient, and criterion for the separation of various vapors (K_p) were determined to

estimate the surface-layer sorbents' quality and properties. The surface-layer sorbents' chromatographic properties were found to depend on the active sorbent used, the amount of active sorbent, and the type of solid carrier. The analytical packed columns containing the study surface-layer sorbent specimens had CO capacity coefficients ranging from 0.5 to 1.4. Inerton AW with 33 percent NaX, Celite-545 with 20 percent NaX, and chromosorb G-AW with 30 percent NaY had the highest capacity and separative power. The surface-layer sorbent proved more efficient than did the bulk sorbent used for purposes of comparison: Unlike the conventional sorbent, at high carrier gas velocities (100 to 300 ml/min), when the wash-out of the moving band of sorbate is dictated by the kinetics of mass transfer only in the near-surface layer, the surface-layer sorbent manifested only a slight drop in efficiency. Use of the surface-layer sorbent thus made it possible to reduce the height equivalent to a theoretical plate and to simultaneously reduce the generally observed dependence of the increase in height on an increase in carrier gas velocity, which is especially important when performing fast analyses. When high-efficiency columns filled with surface-layer sorbent were used, fast analysis of a mixture of fixed gases was completed in only 10 to 13 seconds (versus the 6 minutes required in the case of a column filled with bulk adsorbent). In columns of a surface-layer sorbent containing NaX, K_p equaled 1.67 for nitrogen/nitrogen oxide vapor and 1.52 for nitrogen/carbon oxide vapor. Figures 5; references 2 (Russian).

Modified Sorbents Based on Commercial-Grade Carbon

947M0033D Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol. 67 No. 10, Oct 93 pp 2056-2058

[Article by O.E. Babkin, G.K. Ivakhnyuk, and N.F. Fedorov, Saint Petersburg Technology Institute; UDC 661.183]

[Abstract] A study examined ways of varying the number of functional groups on the surface of mesoporous and macroporous carbon sorbents. A method of directed hydroxylation of the surface of a uniformly mesoporous carbon sorbent that had been subjected to heat treatment in a vacuum at 2,200°C for 4 hours was tested. The carbon specimens were subjected to chlorination at temperatures between 200 and 600°C. Additional treatment of the chlorinated specimens resulted in the attachment of hydroxyl groups to the carbon surface. The said treatment was conducted at 200°C until the release of HCl ceased. The adsorbents thus produced were subjected to adsorption studies; microcalorimetry; and mass, infrared, and x-ray photoelectron spectroscopy. Both qualitative and quantitative differences between the starting specimens and the hydroxylated specimens were evident. The infrared and x-ray photoelectron spectra of the hydroxylated specimens contained bands with peaks at 1050 and 1120 cm^{-1} that were identified as stretching vibrations of the C-OH bond. Directed hydroxylation changed the chemical properties of the surface of the carbon specimens; specifically, it changed the number of primary centers of adsorption of water vapors. The greatest number of primary centers of water vapor adsorption formed when a chlorination temperature of 450°C was used. The proportionality between the number of primary centers of water vapor adsorption and ceiling water vapor sorption that is expected during the process of water-vapor saturation as identical water clusters form on the surface of carbon sorbents did not occur during the experiments. This lack of proportionality was attributed to an uneven distribution of primary centers of water vapor adsorption along the adsorbent's surface that in turn led to partial coalescence of the water clusters and to the formation of "islands" of water. The decrease in the number of hydroxyl groups on the surface of the sorbents that occurred at 200 and 600°C caused the surface of the carrier to fill to a lesser extent. As a result, a proportionality between the number of primary centers of water vapor adsorption, ceiling water vapor sorption, and heat of submersion in water for the hydroxylated specimens began to be evident. This principle was recommended for use in producing produce model sorbents that may be effectively used to produce active and stable immobilized enzyme preparations. The technique of grafting amino groups to a hydroxylated carbon surface was said to be superior to that of grafting amino groups to hydrated silica because the undesirable hydrogen bonds that form in the case of the silica gel do not form when hydroxylated carbon is used as a substrate. The surface of the most hydroxylated specimen produced was determined to contain 1 hydroxyl on every 80 square angstroms, which is sufficient to accommodate at most about 20 amino groups in the case of an enzyme such as trypsin. For this reason, multiple-point binding was recommended as highly desirable for increasing the stability of immobilized preparations. Figures 4, table 1; references 7: 6 Russian, 1 Western.

Technological Bases of Directed Synthesis of Model Adsorbents for Chromatography

947M0033C Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol. 67 No. 10, Oct 93 pp 2052-2055

[Article by G.K. Ivakhnyuk, O.E. Babkin, and N.F. Fedorov, Saint Petersburg Technology Institute; UDC 661.183]

[Abstract] The process of synthesizing sorbents and chromatographic carriers based on ultradisperse powders not only permits wide variation of the pore structure and surface properties but also makes it possible to create materials with actively sorbing surface pores. Packing and fixing ultradisperse particles in the form of granules and/or products makes it possible to obtain sorbents with uniform pores (i.e., with a narrow distribution of meso- and macropores). Grafting compounds with specified chemical properties to the surface of sorbents with uniform pores is, for example, necessary for immobilizing enzymes for chromatographic separation. The effectiveness of this technique may be seen by

comparing the characteristics of starting and hydroxylated mesoporous carbon sorbent based on commercial-grade carbon. Hydroxyl groups located on the surface of carbon sorbents may also be used effectively to graft other functional groups such as amino groups, which may in turn serve as centers for immobilizing biologically active compounds. Sorbents based on ultradisperse powders may be produced by 1) creating primary transport porosity in the molding stage and 2) using heat treatment to develop meso- and macroporosity with a narrow distribution of pores from the standpoint of equivalent radii (with the pore volume and pore radius being determined by the diameter of the starting ultradisperse particles, molding pressure, amount of binder, and sintering temperature). Sorbents synthesized in this manner have a well-developed porosity (0.50 cm^3/cm^3, no micropores, and a narrow distribution of pores from the standpoint of equivalent radii. Additional thermochemical treatment in the form of high-temperature chlorination (or vapor-gas activation of carbon sorbents) may then be used to develop the volume of adsorbing micro- and supermicropores while maintaining transport porosity. In this way it is possible to synthesize adsorbents with a bipore structure from ultradisperse powders of materials that are not themselves active sorbents, such as metal carbides or metalloids. High-temperature chlorination of carbides or carbonitrides makes it possible, thanks to layer-by-layer reaction, to create a porous actively sorbing carbon layer. Such absorbents have proved to significantly reduce the time required for chromatographic analysis without in any way diminishing the separative power under one and the same set of conditions. Figures 6, tables 3; references 6 (Russian).

Mobility of Adsorbed Molecules of Organic Materials on the Ionic Adsorbent Barium Sulfate

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[Article by S.A. Reznikov and L.D. Belyakova, Petrochemical and Coal Chemistry Synthesis Institute and Physical Chemistry Institute, Russian Academy of Sciences, Moscow; UDC 543.544]

[Abstract] The separation and identification of complex mixtures of compounds with similar physicochemical properties require the creation of new heat-resistance adsorbents that are sensitive to the electronic structure of the molecules being separated. In view of this fact, a study examined the mobility of adsorbed molecules (i.e., the changes in the entropy of adsorption) of organic materials on barium sulfate ($BaSO_4$). The changes in entropy were calculated from values of Henry's constant and from changes in internal adsorption energy that were determined by gas chromatography. Experimental and calculated values were derived and compared. It was discovered that saturated hydrocarbons (n-alkanes and n-alkenes) interact with the surface of a $BaSO_4$ adsorbent nonspecifically, mainly on account of dispersion forces. The energy of nonspecific interaction on the surface of $BaSO_4$ is much lower than on the surface of a nonspecific nonpolar adsorbent such as graphitized thermal black (35 versus 49 kJ/mol, respectively, for n-C_8H_{18}). The adsorption of n-alkanes was found to be delocalized, and the heat of adsorption increased as the number of hydrocarbon atoms increased, which is to say that the mobility of the molecules on the surface decreases because of intensification of the dispersion interaction. In the cases of n-hexane and n-heptane, ultramobile adsorption was observed on $BaSO_4$. In a homologous series of n-alkenes, the mobility of the adsorbed molecules decreased as a result of intensification of the dispersion interaction with the surface. The adsorption of aromatic hydrocarbons on the surface of $BaSO_4$ was also found to be delocalized. The molecules' mobility was limited because of π-complexing of the π-electrons of the benzene ring with the Ba^{2+} cations. In the series benzene-butylbenzene, the mobility of the adsorbed molecules decreased as a result of an increase in the contribution of the dispersion interaction of the $BaSO_4$ surface with the alkyl radicals of the alkylbenzenes. The molecules of tetramethylbenzene formed stronger bonds with the surface than those of trimethylbenzene do; however the rotation of trimethylebenzene's molecules is more difficult than is the motion of the molecules of tetramethylbenzene because of the latter's great asymmetry. Adsorption of halogen-containing aromatic compounds was also delocalized; the mobility of their molecules on the $BaSO_4$ surface was limited (i.e., the rotational motion of the molecules was difficult). Adsorption of ethers and both unsaturated and aromatic hydrocarbons on the surface of $BaSO_4$ was delocalized, and the rotational motion of their molecules was difficult because of the interaction of the electron pairs of the oxygen atoms with the Ba^{2+} cations and the interaction of the ether's dipoles with the electrostatic field of the $BaSO_4$ (an orientation interaction). Ethyl acetates were absorbed on $BaSO_4$ with a great deal of energy (the contribution of the energy of the specific interaction to the total energy of adsorption amounted to 43 kJ/mol). Adsorption of nitrogen-containing organic compounds on $BaSO_4$ resulted in the formation of strong complexes because of the nonshared pair of electrons at the nitrogen atom. In the case of pyridine, there was a high degree of localization of its molecules on $BaSO_4$. Tables 3; references 11: 7 Russian, 4 Western.

Adsorption Properties of the Polymer Adsorbents Polysorb-1, Tepasorb-15, and Tenax-GC

947M0033A Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol. 67 No. 10, Oct 93 pp 2005-2009

[Article by I.A. Bardina, N.V. Kovaleva, Yu.S. Nikitin, and I.S. Protonina, Chemistry Department, Moscow State University imeni M.V. Lomonosov; UDC 541.183]

[Abstract] The effectiveness of three porous polymer adsorbents, i.e., Polysorb-1, Tepasorb-15, and Tenax-GC, as absorbers of n-alkanes, aromatic hydrocarbons, ethers, esters, ketones, and n-alcohols was assessed by

gas chromatography on a Tsvet-106 chromatograph with a flame-ionization detector. For each adsorbate in that temperature interval in which the adsorbent peaks were symmetrical and in which the retention time was virtually independent of the sample size (i.e., in the Henry interval), researchers calculated the specific volumes retained ($V_{m,1}$) by each of the three adsorbents. From the dependence lg $V_{m,1}$ on 1/T, the researchers then calculated the adsorbents' differential heat of adsorption during the adsorption of zero samples, standard molar changes in the entropy of the adsorbate, and the extrapolated values of $V_{m,1}$ at 20°C. From the dependence of the differential adsorption heat during the adsorption of zero samples they determined the contributions of the magnitudes of the energy of the specific interaction to the total heat of adsorption. The dependence of lg $V_{m,1}$ on 1/T turned out to be linear for all three polymer adsorbents studied. The values of the heats of adsorption of aromatic hydrocarbons for the three adsorbents were lower than those for n-hydrocarbons with the same number of carbon atoms in the molecule, whereas the retained volumes were higher for aromatic hydrocarbons than for n-alkanes throughout all the temperatures studied. This was taken as an indication of the fact that in the case of aromatic hydrocarbons, dissolution processes may also be at work in addition to adsorption processes. The dependences of the differential heat of adsorption during the adsorption of zero samples on the number of hydrocarbon atoms in the molecule for different homologous series on all three polymers were linear. The adsorption heats found for ketones, ethers, and n-alcohols were different for the different adsorbents. This fact was attributed to the adsorbents' ability to manifest specific reactions with the said adsorbates in addition to dispersion interactions. Polysorb-1 and Tepasorb-15 were found to be virtually inert with respect to ethers; however, they engaged in additional specific reactions with alcohols and ketones on account of the π-electrons of the benzene rings on their surfaces. The highest values of $V_{m,1}$ extrapolated for 20°C were obtained for Polysorb-1, and the lowest were obtained for Tepasorb-15. Both in the present study and elsewhere, the properties of Tenax-GC have been found to remain quite stable from batch to batch. The properties of Polysorb-1, on the other hand, were found to be quite unstable and to vary from batch to batch. Figures 2, tables 7; references 18: 6 Russian, 12 Western.

New Method for Preparing Electroluminescent Films from Zinc Sulfide

947M0028C Moscow NEORGANICHESKIYE MATERIALY in Russian Vol. 29, No. 10, Oct 93 pp 1360-1361

[Article by B. M. Sinelkikov, A. R. Farakhmand, E. M. Sinelnikova, and N. I. Kargin, Polytechnical Institute, Stavropol; UDC546.47'221+539.216.2]

[Abstract] Growing interest in zinc sulfide as a material for use in optical-electrical devices precipitated the problem of preparing this substance having the required properties of microcrystallinity, departure from stoichiometry, content of basic substances, etc. In the present work a study was made of the effects of some technological factors on the properties of zinc sulfide films and the possibility of regulating their physical chemical properties during the growth process. Thus the rate of zinc sulfide formation at constant magnetic field stress, was found to be significantly affected by the presence of iron impurities in the solution. Also, the strength of the magnetic field affects the structure of the water and the zinc salt complex becomes a factor. As the field strength increases, old structures break down and new ones are formed. Increasing the concentration of iron ions in the solution only increases the overall rate of the reaction. Particle size data on zinc sulfide powders shows that raising the pH from 11.40 to 11.44 results in a marked improvement in structure and mirror finish of the film. Figures 2; references 6 (Russian).

Luminescence of LiH(D):Ru Single Crystals

947M0028B Moscow NEORGANICHESKIYE MATERIALY in Russian Vol. 29, No. 10, Oct 93 pp 1348-1349

[Article by A. A. Sabirzyanov, D. V. Oparin, G. I. Pilipenko, and F. F. Gavrilov, Ural Polytechnic Institute imeni S. M. Kirov, Yekaterinburg; UDC546.34+541.44]

[Abstract] Luminescent lithium (deuterium) hydride could possibly be used as a neutron scintillation detector, since it is assumed to be highly efficient in detecting neuron scintillation and in being highly sensitive to γ-radiation. Also, the simplicity of the lithium hydride structure facilitates its fundamental study. LiH luminescence was first detected in samples activated with magnesium. Later, studies were made with lithium hydride activated with mercury-like ions, although the nature of the mercury-like coloration sites in LiH(LiD) has not yet been established. Luminescence of palladium-group ions in lithium (deuterium) hydride has not yet been observed. In the present work single crystals of LiH(D):Ru were grown and their luminescence spectra studied for the first time. The spectra displayed features related to the structure (progression along a valent local fluctuation of hydride ions in the doped center) and fluctuations of the base lattice. A qualitative simulation of the luminescence site is presented. Figures 2; references 10: 7 Russian, 3 Western.

Status and Developmental Prospects of Antistokes Luminophores for IR-Visualizers in Range 0.8-13 MKM

947M0028A Moscow NEORGANICHESKIYE MATERIALY in Russian Vol. 29, No. 10, Oct 93 pp 1322-1325

[Article by O. Ya. Manashirov, D. K. Sattarov, V. B. Smirnov, O. V. Tsyurupa, and A. V. Kurochkin, PO "Lyuminofor"; UDC535.37+543.422.4]

[Abstract] The development of hybrid-cascade solid state visualizers for near infra-red radiation (0.8-13 mkm) using antistokes luminophores (ASL) provided a new impulse to the research and development of these materials. The mechanism for accumulating and transmitting energy by

rare earth metal ions and the fundamental properties of known ASL matrices activated with rare earth metal ions determine the lower density limit of power P_{min} and its associated upper wavelength limit λ_{max} of transformed infra-red radiation. Visualizers and the luminophores used in them may be divided into three groups, depending on intended use and design. The simplest visualizer is intended for observations made with the naked eye of relatively weak infra-red sources (light emitting diodes, lasers), and it consists of an ordinary screen covered with a layer of ASL within which the entire infra-red transformation process takes place. Visualizers for "weak" fields ($\leq 10^{-2}$ watt per cm^2) are capable of transforming IR-radiation of 1.1 mkm or greater into visual, such as objects viewed in a dark moon-less night. The spectral make up of this type of illumination is determined by the transmission lines of water vapor, one of which takes place in the 1.4-1.6 mkm range. These visualizers embody a hybrid-cascade layout which includes a screen having an ASL and a phototransformer. Here, the luminescent screen transforms the 1.4-1.6 lines into the shorter IR region of 0.8-1.1 mkm with the phototransformer performing the dual functions of intensifying and transforming the glow from the luminophore into illumination on the exit screen. The most promising trend in the development of antistokes infra-red visualizers with $P_{min} < 10^{-2}$ watt per cm^2 and $\lambda_{max} > 1.1$ mkm may be realized under the conditions of a quantum counter in a parametric converter of the "heterodyne" type. Its operation is based on the properties of several ASL to increase the intensity of a spectral line in the presence of two other radiations, one of which has a long wavelength and serves as excitation source, while the other of another wavelength serves as a signal. Results obtained provide a basis for considering the second and third trends as the most promising for visualizers of weak and ultra-weak infra-red radiation in the 1-13 mkm range. Their realization requires the development of new, nontraditional methods and devices for parametric excitation, as well as the development of new classes of antistokes luminophores. Figures 2; references 17: 16 Russian, 1 Western.

CHEMICAL INDUSTRY

Nature and IR-Spectral Characteristics of Chemically Modified Ultradisperse Detonation Diamonds

947M0032A Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA -SERIYA 2 KHIMIYA in Russian Vol. 34 No. 5, Sep-Oct 93 pp 506-510

[Article by I.I. Kulakova, B.N. Tarasevich, A.P. Rudenko, N. Dorzhpalamyn, and T.M. Gubarevich, Petrochemistry and Organic Catalysis Department, Moscow State University; UDC 662.215.1'666.233:543.422]

[Abstract] Ultradisperse diamonds were obtained from trinitrotoluene by shock-compression synthesis. They were separated from the residual solid products by treating the latter first with an organic solvent (saturated or aromatic hydrocarbon) at a temperature of 400° and pressure of 250 atm and then with a mixture of concentrated H_2SO_4 and HNO_3. In aqueous solutions, the ultradisperse diamonds (3 to 8 x 10^{-3} μm in diameter) thus separated formed aggregates up to 200 μm in size. Externally, the ultradisperse diamonds were a dense dark gray powder. Elemental analysis established that they consisted of the following (percent): C, 78.6-78.8; H, 0.65-0.70; O, 16.5-17.0; N, 1.78-2.16; and ash residue, 2.47-1.34. The large amounts of oxygen found in the functional groups on the surface of the ultradisperse diamonds were attributed to the oxidation treatment, as well as to the presence of oxygen (and nitrogen) in the diamonds' defect lattices in the form of various impurity centers during the shock-compression synthesis process. A comparison of the infrared spectra of the ultradisperse diamonds before and after modification confirmed the stability of the diamonds' different functional groups and the change in the chemical state of their surfaces. The presence of different types of nitrogen impurity centers in the ultradisperse diamonds was also confirmed by infrared spectroscopy. Figures 2, table 1; references 9: 7 Russian, 2 Western.

Selective Electrochemical Deposition of Metals Onto the Surface of TiO_2 Films

947M0031A Moscow ELEKTROKHIMIYA in Russian Vol. 29 No. 10, Oct 93, pp 1275-1277

[Article by V.P. Poroshkov, V.S. Gurin, and N.I. Kuntsevich, Physicochemical Problems Scientific Research Institute, Byelarus University, Minsk; UDC 541.138.3]

[Abstract] TiO_2 films were produced on a metallic titanium surface by hydrolysis of a solution of polybutyltitanate in air. The resultant amorphous films were heated at a temperature of 450 to 500°C for 1 hour. This resulted in the formation of an anatase modification of a polycrystalline TiO_2 film (i.e., Ti-TiO_2). Next the electrochemical deposition of Cu, Pd, and Ag onto the surface of Ti-TiO_2 electrodes was studied. The deposition was performed from a solution containing nitrates of the respective metals with a concentration of 10^{-5} to 10^{-3} M. In some of the experiments, the deposition was conducted under continuous ultraviolet irradiation in an electrochemical cell. Preliminary electrochemical deposition of the metal particles onto the surface of the Ti-TiO_2 electrodes was accomplished by cathode deposition of a calculated amount of metal in a galvanostatic mode. Some of the electrodes were modified by adsorption of Pd^{2+} ions from a 0.005 M $PdCl_2$ solution for 10 to 1,000 seconds under closed-circuit conditions. The electrochemical experiment was conducted in a conventional electrochemical cell with a P-5827M potentiostat. Saturated Ag chloride served as the normal electrode, and a platinum electrode served as the auxiliary electrode. The experiments established that the deposition of each of the aforementioned metals on TiO_2 electrodes occurred with a higher cathode overvoltage than on metallic electrodes in the respective solutions. Preliminary electrochemical deposition of Ag particles onto the electrodes at a surface concentration of 10^{14} atoms/cm^2 or less resulted in a

decrease in the Ag deposition overvoltage by more than 0.1 V. Modification of the electrode surface by Cu particles in amounts up to 10^{15} to 10^{16} atoms/cm^2 resulted in only a slight shift of the cathode arm of the potentiodynamic curve to the negative side. Nor did preliminary electrochemical modification by Pd particles with a concentration of 10^{15} atoms/cm^2 have any significant effect on the position of the cathode arm when it was Pd that was being electrochemically deposited. Only when the amount of Pd deposited in advance was increased to 10^{16} atoms/cm^2 did the deposition potential shift by 0.05-0.1 V. Preliminary modification of the electrode surface by Ag in the amount of 10^{16} atoms/cm^2 resulted in a shift in the cathode arm of the potentiodynamic curve to the positive side, i.e., it resulted in a decrease in the cathode overvoltage of the metal's deposition as compared with that in the case of an unmodified electrode. Irradiation of the TiO_2 electrodes with ultraviolet radiation during the electrochemical process did alter the potential of the deposition of Cu or Pd. In the case of Ag, however, irradiation caused an decrease in the overvoltage of the metal's deposition by more than 0.1 V and a significant increase in process rate. When Ti-TiO_2 electrodes in contact with a 0.005 M $AgNO_3$ solution were subjected to ultraviolet irradiation (H = 0.1 J/cm^2), photolytic silver particles ranging in size from 5 to 50 nm formed in a concentration of 10^8 to 10^9 cm^{-2} (with a predominance of particles measuring 5-10 nm in size). As the electrodes' exposure increased (H = 1 J/cm^2), the concentration increased (to 10^{10} cm^{-2}) with virtually no change in the particles' size distribution. Only at much higher exposures (to 10 J/cm^2) did larger particles (50-100 nm) appear and smaller particles (5-10 nm) disappear. Cathode polarization of the Ti-TiO_2 electrode coupled with simultaneous ultraviolet irradiation resulted in particles that were an order of magnitude larger than those formed when the deposition process was conducted with no irradiation. The significant differences observed for the selectivity of the deposition of Cu, Ag, and Pd was attributed to the fact that the energy levels of the metal particles created did not in all cases correspond with the position of the Fermi level of TiO_2. Kinetic factors involved in the growth of the particles of the metal phase were also implicated. Figures 3; references 4 (Russian).

Synthesis, Structure, and Physicochemical Properties of Complexes of Copper (II) Chloride With 3,3-Dimethyl-1-(4',4'-dimethylcyclohexa-2',6'-dione-1'-yl)-3,4-dihydroisoquinoline. Crystalline and Molecular Structure of Catena-[*trans*-dichloro-μ-[3,3-dimethyl-1-(4',4'-dimethylcyclohexa-2',6'-dione-1'yl)-3,4-dihydroisoquinoline-0,0]Copper(II)]

947M0030A Moscow KOORDINATSIONNAYA KHIMIYA in Russian Vol. 19 No. 10-11, Oct-Nov 93 pp 803-808

[Article by V.V. Davydov, V.I. Sokol, Ye.V. Balebanova, V.K. Belyayeva, Yu.V. Shklyayev, I.N. Marov, B.Ye. Zaytsev, and M.A. Poray-Koshits, Russian Friendship of the People University, General and Inorganic Chemistry Institute imeni N.S. Kurnakov, Russian Academy of Sciences, and Geochemistry and Analytic Chemistry Institute imeni V.I. Vernadskiy, Russian Academy of Sciences; UDC 541.49:546.562:547.833]

[Abstract] Complexes of copper (II) chloride with 3,3-dimethyl-1-(4',4'-dimethylcyclohexa-2',6'-dione-1'-yl)-3,4-dihydroisoquinoline were synthesized. An equimolar quantity of $CuCl_2 \cdot 2H_2O$ solid crystal hydrate was added to a solution of 0.3 mmol of ligand in 5 ml CH_3CN at room temperature. The mixture was stirred intensively until the salt dissolved and then held for 2 days. The resultant light green crystals were filtered off, rinsed with hexane, and dried over $CaCl_2$. When chemically pure acetone was used as the solvent, small acicular yellow crystals were formed. The $CuCl_2L$ complexes were subjected to x-ray crystallographic analysis on a CAD-4 diffractometer, infrared spectroscopy on a Specord 751R, and EPR studies on an SE/X-2544 EPR spectrometer (Radiopan). The crystals of the compounds formed were classified as triclinic with lattice parameters as follows: a = 8.391(1), b = 10.486(2), and c = 6.42(7) angstroms; α = 81.07(3), β = 87.27(3), and γ = 72.04(1)°; V = 962.5(6) A^3; Z = 2; and limiting boundary = P1. The x-ray crystallographic analysis established that in the complex, the cyclohexanedioneisoquinoline functions as a bridge ligand that is coordinated to its two neighboring copper atoms through the oxygen atoms of the carbonyl groups of the cyclohexanedione fragment of the molecule. The studies further established that the ligand in the complex has the very same tautomeric form as in a uncoordinated state. The spectrochemical characteristics of the tautomeric form and the method of coordination of dihydroisoquinolinecyclohexanedione were determined. The EPR spectroscopy studies confirmed Cu-Cu magnetic interaction in polycrystalline samples of the complexes. The degree of polymerism of the polycrystalline specimens studied was found to depend on the quantity of crystallization water present in them. Figures 3, tables 2; references 4: 3 Russian, 1 Western.

Combined Processing of Pyrolysis Gasoline and Production of Aromatic Hydrocarbons and High-Octane Gasolines

947M0017A Moscow KHIMIYA I TEKHNOLOGIYA TOPLIV I MASEL in Russian No. 11, Nov 93 pp 7-8

[Article by A.D. Guseynov, S.M. Asker-Zade, Alrofo Maruan Mubarak, A.B. Babayev, Gamal Salim Al-Aseri, S.G. Yunusov, and M.I. Rustamov, Institute of Petrochemical Processes, Azerbaijan Academy of Sciences; UDC 665.633.252:665.642.9]

[Abstract] An optimum process flow for refining pyrolysisgasoline that makes it possible to obtain both benzene and AI-93 high-quality unleaded gasoline was developed on the basis of a process that was previously developed at the Institute of Petrochemical Processes of the Azerbaijan Academy of Sciences. Three versions of the pyrolysis gasoline refining process were studied: 1) catalytic enrichment; 2) removal of the 70°C-90°C benzene fraction from the pyrolysis gasoline for subsequent enrichment; and 3) removal of the benzene fraction for

petrochemical purposes, removal of the low-boiling through 70°C (l.b.-70°C) fraction for subsequent etherification by C_1-C_3 monohydric alcohols, and removal of the 70°C through catalytic cracking (70°C-c.c.) fraction for catalytic enrichment and subsequent mixing with the l.b.-70°C fraction after etherification. The catalytic enrichment was conducted on a consolidated laboratory unit with a fluidized bed of zeolite-containing catalyst such as Tseokar-2 at a temperature of 100-120°C and pressure of 2.5-3 MPa. When pyrolysis gasoline was subjected to catalytic enrichment under stringent conditions (i.e., at 520°C), a yield of gasoline with an octane number of 85 according to the motor method (98 according to the research method) of 82.9 percent was achieved; however, the said gasoline had a high aromatic hydrocarbon content (49.2 percent). Under less stringent conditions (i.e., at 480°C), the gasoline yield increased to 87.2 percent and the content of aromatic hydrocarbons dropped to 37.2 percent (the said gasoline had an octane number of up to 83.5 according to the motor method and 94.5 according to the research method). Catalytic enrichment of pyrolysis gasoline without the 70-90°C fraction resulted in an 84.8 percent yield of gasoline with an octane number of 85 (motor method) and with an aromatic hydrocarbon content of 39 percent. The third version of the process resulted in a 5 percent increase in gasoline yield. The said gasoline had a reduced aromatic hydrocarbon content and an oxygen-containing compound content of 2.5-2.6 percent. In addition to boosting aromatic hydrocarbon production efficiency, the new process flow also eliminates a number of the problems involved in producing high-octane fuels. Tables 2; references 2 (Russian).

Increasing Hydrogenation Activity of Industrial Selective Hydrocracking Catalysts

947M0018A Moscow KHIMIYA I TEKHNOLOGIYA TOPLIV I MASEL in Russian No. 11, Nov 93 pp 9-12

[Article by N.S. Khashagulgova, L.L. Freyman, Yu.N. Zelentsov, B.K. Nefedov, and I.Ye. Gorbatkina, All-Russian Scientific Research Institute of Petroleum Refining and Angarsknefteorgsintez Production Association; UDC 66.097.3:665.654.2]

[Abstract] Zeolites with a pentacyl structure, such as TsVK, TsVM, TsVM, and ultrasil, are the main catalysts used in hydrodeparaffinization or selective hydrocracking of n-paraffin hydrocarbons. To produce high-quality transformer oils from paraffin raw materials, these catalysts must possess not only a high splitting activity but also a sufficient hydrogenating activity. Most hydrogenating heterogeneous catalysts contain either noble or rare earth metals or else group VI metals. Catalysts containing a nickel-molybdenum complex have a higher hydrogenating activity than do catalysts into which metals have been added by coextrusion or impregnation. Deposition of a nickel-molybdenum complex on solid carriers (alumirosilicates or zeolites) helps increase their hydrogenating activity and thus helps decrease the content of hydrogenating metals in the catalyst. A catalyst's isomerizing activity and its ability to redistribute hydrogen (thereby reducing the yield of unsaturated compounds) increases in the presence of small quantities of wide-pore zeolites (mordenite or ultrastable Y). Tungsten helps increase a catalyst's hydrogenating activity in relation to polycyclic aromatic compounds, and zinc and chromium reduce metals' migration and thereby increase their dispersion and the stability of a catalyst's operation. Zinc facilitates aromatization of paraffins, and chromium compounds possess an independent hydrogenating activity. These and other laws were used to develop a new catalyst, SGK-5, which is designed to replace the combination SGK-1 plus type AKM hydrogenating catalyst. SGK-5 contains nickel and molybdenum as its hydrogenating components. SGK-5 is simpler to use than the SGK-1 + AKM combination; however, it has not been possible to fully hydrogenate unsaturated compounds in the presence of SGK-5 (despite the fact that it has a higher hydrogenating activity than the SGK-1 + AKM combination). For this reason, studies were undertaken to increase the hydrogenating activity of SGK-5. Eight different versions of SGK-5 were produced and compared. The comparative tests established that catalysts containing 16 to 20 percent (wt) nickel-molybdenum complex have a high hydrogenating activity coupled with a high yield of target fraction. When the nickel-molybdenum complex exceeds 20 percent, the zeolite content decreases, which has an unfavorable effect on the product pour point. Catalysts based on type TsVN zeolite were found to result in a target fraction with a low pour point. Type TsVM-III zeolite and wide-pore zeolites resulted in somewhat of an elevation of the product pour point; however, the addition of dealuminized mordenite had a favorable effect on yield of the target fraction. Roasting just at 340°C did not result in adequate activation of the zeolite component of the catalyst or (consequently) the necessary product pour point. Staged roasting at 340 and 500°C proved optimum. Tables 2; references 18: 14 Russian, 4 Western.

Adiathermic Glasses Having Special Course of Dispersion

947M0029A Moscow STEKLO I KERAMIKA in Russian No. 11-12, Nov-Dec 93 pp 8-11

[Article by S. G. Kozhevatkin, M. V. Artamonova, and V. I. Molev, PO "Lytkarinskiy Zavod Opticheskogo Stekla"; UDC666.11.01]

[Abstract] Development of a new generation of apochromatic objective lenses requires optical materials having special properties. Optical glasses having a large variety of optical constants and other parameters which make it possible to develop optically perfect systems, play a leading role among such materials. A pressing problem is the development of glasses having both a special course of dispersion and low thermo-optical constant (TOP). These are called adiathermal glasses. The joining of special course of dispersion with low TOP makes it possible to develop systems which are non-misaligning

under apochromatic-anastigmatic temperature gradient conditions with corrected secondary spectrum. With such systems the number of lenses in complex objective lens systems is determined by the special properties of the glasses and may be minimized. The majority of industrial glasses produced here and abroad do not simultaneously have adiathermal properties and special courses of dispersion. In the present work a series of adiathermal optical glasses with special courses of dispersion were developed. Data was also obtained which may be used in the synthesis of special purpose adiathermal glasses. Adiathermal phosphate glasses with special course of dispersion and fitting in various areas of the Abbe diagram were developed which have a number of advantages over similar industrial glasses. Calculations show that objective lenses consisting of the newly developed glasses are not inferior to industrial glasses in longitudinal chromatic aberration (secondary spectrum) and have less thermo-optical and thermowave aberration. Figures 3; references 7: 4 Russian, 3 Western.

Structural Features and Properties of Periclase Ceramics, Doped With Oxides of Rare Earth Elements

947M0029B Moscow STEKLO I KERAMIKA in Russian No. 11-12, Nov-Dec 93 pp 22-25

[Article by V. S. Gvozd, Sumskiy Agricultural Institute; UDC666.762.64:666.046.51]

[Abstract] The effects of various additives on the sintering and structure of magnesium oxide has been studied in the course of the development of periclase (magnesia) ceramics technology. Substances capable of forming solid solutions with periclase, which have lattice defects and thereby accelerate diffusion processes, significantly affect solid phase sintering. Effective activity has been observed in oxides having greater valency than magnesium. There appears to be contradictory evidence in the case of interaction of magnesium oxide with CeO_2 and Nd_2O_3. In the present work with these oxides, phase composition of calcined samples was controlled with a special device and lattice parameters were deduced from profile lines obtained by scanning diffractometry. Microstructure was studied with both reflected and transmitted light. The results of the investigation led to the development of a technology for the preparation of a vacuum-tight structured periclase ceramic which functions successfully while in contact with melts and vapors of high-melting alkali metals and carbons. Stable metal-ceramic structural materials of the ceramic-alloyed steel-ceramic type, capable of being used in electronics and magnetohydrodynamics, were prepared by thermal-compression welding under vacuum. Figure 1; references 7: 4 Russian, 3 Western.

Some Properties of Current-Carrying Coatings

947M0029C Moscow STEKLO I KERAMIKA in Russian No. 11-12, Nov-Dec 93 pp 41-42

[Article by G. G. Mamedova and S. P. Rodtsevich, General and Inorganic Chemistry Institute, Minsk; UDC666.59]

[Abstract] Large-scale use of electric heating films capable of providing surface heat emission at low heater-to-object temperature gradients, makes it is necessary to develop low-cost metal-ceramic and ceramic resistor coatings on ceramics and to study the effects of some technological factors on their properties. The use of any particular ceramic as an electric heater coating is hindered by the mutual diffusion between both the components of the film and its substrate which leads to chemical reactions in the interfacial zones resulting in a rise in the resistance of the coating to cause mechanical stresses which inhibit conducting processes. In this respect, the highly clayey ceramic (22KhS) is of considerable interest since it is chemically inert and does not react with the coating material. The problem of making low cost film heaters may be resolved through study of metal-ceramic (Me-clay-glass) and ceramic (transition metal oxide-glass former) systems. Selection of the proper material used in a system depends on the following considerations. In the first system the metal is used as a base for an electrically conducting component; the clay is needed to support the slip in a suspended state. Also, after losing its water of hydration, clay becomes more chemically active and reacts with metals to form the conducting phase, while glass serves to bind the metal particles to the ceramic base. In the second system, during the calcining process, the transition metal oxides form cations of varying valencies of the same element to provide the needed conditions for electrical conductivity. The oxide-glass former plays the same role as glass does in the first system. Slips, prepared using 3d-elements (nickel, titanium, iron, copper, and chromium) and alloys of these elements with aluminum, boron, phosphorus, and silicon, were applied to ceramic objects by dipping or coating and tested for resistance to heat, cold temperatures, and moisture. Films containing Fe, Co, Ni, Mn, Mo, V, La, and Nb oxides had the best electrical conductivities, and negative temperature coefficients of resistance. On heating, resistance drops rapidly and the objects become overheated and burn out unless a thermo-regulator is used. The coatings are resistant to vibration, cold, and moisture. References 2 (Russian).

MISCELLANEOUS

Synthesis, Structure, and Properties of N-(trihalogermylmethyl)-Substituted Amides, Lactams, and Imides—Compounds of Pentacoordinated Germanium

947M0021B Moscow IZVESTIYA AKADEMII NAUK RAN SERIYA KHIMICHESKAYA in Russian No. 10, Oct 93 pp 1793-1799

[Article by T.K. Lak, O.A. Dombrova, D.A. Ivashchenko, and V.F. Mironov (deceased), State Scientific Research Institute of the Chemistry and Technology of Elementoorganic Compounds, Moscow; UDC 547.235+547.246]

[Abstract] N-(trihalogermylmethyl)-substituted amides, lactams, and imides are pentacoordinated germanium derivatives that manifest antineoplastic and immunomodulating neurotropic properties. A series of experiments were conducted to find simple methods of synthesizing trichlorogermyl-substituted amides, lactams, and imides. The experiments confirmed that it is just as easy to form trichlorogermyl-substituted amides, lactams, and imides by condensing $HGeCl_3$ with compounds containing the fragment NCH_2Cl as it is to form the said compounds by reacting $HGeCl_3$ with compounds containing the groupings NCH_2OH and NCH_2OH. The yields of the products RCH_2GeCl_3 produced during the experiments reached 70-83 percent, which is 10-25 percent higher than when the respective N-methylolamide or N-methylolimide is used. Further studies of the chemical properties of amides, lactams, and imides with a $Cl_3GeCH_2NC(O)$-group established that the phthalamide derivative, unlike previously studied amide and lactam derivatives, splits upon boiling in concentrated hydrochloric acid. Next, several never-before-synthesized tribromo- and triiodogermyl derivatives were produced. In those cases where the intermediately formed sesquioxanes were water soluble and difficult to isolate, a new technique was used to obtain triiodogermyl derivatives, i.e., the effect of concentrated hydriodic acid directly on the respective trialkolxygermane. The new compounds were subjected by x-ray crystallographic and elemental analysis. The newly synthesized compounds were confirmed to contain a pentacoordinated germanium atom. Tables 3; references 17: 13 Russian, 4 Western.

Synthesis of New Spin-Labeled Crown Ethers

947M0021A Moscow IZVESTIYA AKADEMII NAUK RAN SERIYA KHIMICHESKAYA in Russian No. 10, Oct 93 pp 1770-1772

[Article by V.A. Reznikov, T.A. Berrezina, L.B. Volodarskiy, and E.G. Lubenets, Novosibirsk Institute of Organic Chemistry, Siberian Department, Russian Academy of Sciences, Novosibirsk; UDC 547.781.3+547.898]

[Abstract] Spin-labeled crown ethers containing a spin label both in and not in direct proximity to the coordination sphere have been produced previously. In both cases, coordination of the nitroxyl group with the metal ion in the complex was not observed. For this reason, new ways of introducing a spin label at the amino group of easily accessible amino derivatives of crown ethers were proposed. Diazonium salts prepared from aminophenyl-substituted crown ethers were reacted with a paramagnetic imidazolinium salt to form spin-labeled crown ethers containing an arylazoenamine group as a component of the molecule. A second approach to synthesizing spin-labeled crown ethers was also proposed. It entailed reacting amino derivatives with paramagnetic isocyanate, which reacts with amines to form paramagnetic ureas. Equimolar quantities of isocyanate and amine were mixed to produce spin-labeled crown ethers that, together with an NaOH water-alcohol solution, form paramagnetic amidines. The latter approach makes it possible to synthesize spin-labeled crown ethers that contain an amidine grouping as a component of the molecule. This in turn makes it possible to control pH in a study micro-object by means of electron paramagnetic resonance. Table 1; references 9: 3 Russian, 6 Western.

ANALYSIS, TREATMENT, MINING

Strain Aging of Maraging Steels Subject to Fatigue

947D0005A Moscow METALLY in Russian No. 6, Nov-Dec 93 (manuscript received 12 Nov 92) pp 132-146

[Article by I.Zh. Bunin, T.V. Korzh, T.F. Terentyev, Ye.G. Kurzina, and S.M. Kalinina, Moscow; UDC 669.15:539.43]

[Abstract] An experimental study of maraging alloy steels was made concerning their fatigue strength and the mechanism of crack propagation in them under cyclic loads. The industrial-grade EP 678 steel (0.022% C, 10 9.30% Ni, 1.95% Mo, 0.84% Ti, 0.09% Cu, 0.088% Al, 0.06% Zn, 0.02% Mn, 0.01% Nb, 0.14% Si, 0.008% P, 0.007% S, 0.002 B) had been selected as a representative of this group. Ingots of this steel were heat treated as follows: quenching from 950-970°C in water for 30 min + aging at 520+/-10 for 3 h. For fatigue tests and for microstructural examination they were cold-rolled into 3 mm thick strips after quenching and into 2 mm thick strips after aging. Some of the steel was quenched from 980°C and then cold-rolled into rods 50 mm in diameter for extra test. For determination of its standard mechanical properties, some of the steel was cold-rolled into rods 5 mm in diameter and specimens were cut out of them with the axis oriented in the direction of rolling. Cracking resistance under static loads was determined on 15 mm thick prismatic specimens under eccentric tension. For a determination of cracking resistance under impact loads acting perpendicularly to the direction of rolling, 10 mm square and 55 mm long bar specimens with a 1 mm deep notch were tested in a Charpy machine. Cyclic testing at a 50 Hz frequency was done: 1) in an Instron-1603 machine on rods 50 mm in diameter under pure flexure, for determination of the endurance limit;2) in an Instron-1253 machine on 2 mm and 3 mm thick 50x300 mm^2 large plates, for exploration of the fatigue fracture micromechanisms during steady crack growth and during accelerated crack growth. All mechanical tests were performed at 20°C temperature. Microstructural examination was done under a Neophot-3 optical microscope, under a JEM-200 electron emission microscope by the method of replicas, and under a JSM-U3 scanning electron microscope. Specimens for this examination were electropolished with an electrolyte containing 1 g CrO_3 + 65 ml H_3PO + 15 ml H_2SO_4 and etched with an HNO_3:HCl= 3:1 mixture. Particular attention was paid to the zone of intense plastic deformation at the tip of a growing fatigue crack, metallographic examination having revealed here pores and discrete discontinuities along the grain boundary. The results of this study, including diagrams of fatigue fracture kinetics based on the test data, correlate with the hypothesis of fractal geometry in nature (B.B. Mandelbrot, 1984) and the theory of self-organized criticality (P. Bak, K. Chen; V MIRE NAUKI, No. 3, 1991.). The authors thank L.G. Orlov for helping with microstructural examination. Figures 6; tables 2; references 40.

Microstructure and Properties of Construction Steels After Heat Treatment to Perlite Structure

947D0011A Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 10, Oct 93 pp 10-13

[Article by Yu.M. Brunzel, Ya.B. Gurevich, and I.M. Fomin, Central Scientific Research Institute of Ferrous Metallurgy imeni I.P. Bardin; UDC 621.789: 669.14.018.298]

[Abstract] A study examined the mechanical and technological properties of construction steels subjected to thermomechanical treatment to the point of transformation to a perlite structure. Ingots weighing 35 kg were smelted in an induction furnace and and forged into 35-mm-thick flatbars that were then subjected to thermomechanical treatment to the point where a perlite structure was produced. The flatbars were rolled in six passes to a thickness of 12 mm with a total relative reduction of about 66 percent. The flatbars were subjected to thermomechanical treatment in one of two versions. In the first version the flatbars were heated to 1,200°C and held in the furnace, deformed in rolling cages until they had reached a temperature of 780°C, and then annealed in a heat-treating furnace to a temperature of 600°C (duration, 1.5 hours). In the second regimen the flatbars were heated to 1,000°C, deformed in rolling cages until they had reached a temperature of 650°C, and annealed in a heat-treating furnace at 650°C for 2 hours. In both cases the flatbars developed a perlite microstructure with globular carbides that possessed increased ductility. The structure of the globular carbides produced is optimum for steels subjected to cold deformation during the manufacturing process; however, its machineability is not as good as that achieved by other methods. The flatbars produced by the second regimen were more ductile than those produced by the first regimen. The second regimen resulted in steels with an evenly distributed granular perlite, whereas the first regimen resulted in perlite that had only been 80-90 percent spheroidized (thus resulting in free ferrite in the steel's microstructure). Further studies were conducted to clarify the effect that the microstructure formed during the thermomechanical treatment to the perlite stage has on the mechanical properties of steel after additional hardening heat treatment (hardening with high-temperature tempering). Specimens of 38KhGNM and 40KhN2MA steel were subjected to thermomechanical treatment in the perlite range followed by hardening heat treatment under commercial conditions (halting rolling at 800°C, after which the billets were cooled down in air to 650°C before being put into the furnace for the perlite transformation). The specimens subjected to preliminary thermomechanical treatment in the perlite range proved more resistant to impact bending failure in both hardened and tempered states. Figures 3, tables 2; references 4: 3 Russian, 1 Western.

Features of Structure of Surface Layer of Corrosion-Resistant Steel After Laser Treatment

947D0011B Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 10, Oct 93 pp 34-36

[Article by T.P. Shmyreva, A.G. Nizhnikovskiy, A.V. Potapova, and V.I. Ibatullin; UDC 669.14.018.8: 621.791.72]

[Abstract] Specimens of 30Kh13 steel measuring 2 mm in thickness were subjected to the following finishing heat treatment used to harden medical tools: hardening in oil from 1,000°C and tempering at 150°C for 1 hour. After this treatment the steel's microstructure consisted of martensite with a uniformly distributed carbide phase. Next the specimens were subjected to pulse laser treatment in an argon atmosphere with a Kvant-16 pulse laser unit (W_E = 0.5-3.65 J/mm^2). The focal spot measured 4.0 mm in diameter. Polished microsections made perpendicular to the irradiated surface were used to study the specimens' microstructure on a DRON-2.0 diffractometer. The specimens were also subjected to x-ray phase analysis. Irradiation of the laser-treated specimens at W_E = 0.5 J/mm^2 did not result in any noticeable change in the appearance of their anode potentiodynamic curves as compared with those of the starting steel. After irradiation at W_E = 2.5-2.95 J/mm^2, the carbide peak shifted to the left, and after irradiation at W_E = 3.25-3.50 J/mm^2, the "classic" form of anode potentiodynamic curve similar to the ideal curve of α-iron was observed. The unevenness of the distribution of the energy of the laser irradiation throughout the area of the focal spot and the superimposition of heat-affected zones on one another (resulting in repeated irradiation of selected sections of the steel surface) had a significant effect on the structure and phase composition of the irradiated surface. In addition, metallographic analysis confirmed the definite electrochemical effect of the dissolution of the carbide phase: After irradiation at W_E = 3.25 J/mm^2, no carbide phase was detected in the surface layer, and after irradiation at W_E = 3.65 J/mm^2, the surface was observed to have vitrified (thus indicating that such a laser treatment regimen is unacceptable for treating finished instruments). The biggest increase in hardness of the steel's surface layer (to 800 H) was achieved upon total dissolution of the carbide phase. Analysis of the change in the width of the diffraction peaks recorded for the study specimens indicated that as W_E increases, the width of $B_{(110)\alpha}$ remains virtually unchanged whereas that of $B_{(220)\alpha}$ increases. This increase in microstresses was hypothesized to be at least partly due to the presence of the chemical inhomogeneity of the solid solution that develops during the process of dissolution of the carbide phase. The studies performed thus established the possibility of controlling the regimens used to treat medical instruments so as to increase their microhardness to 800 H without changing the geometry of their cutting edges. Figure 1, tables 2; references 11 (Russian).

Development of Technological Scheme of Loading Metal with Detonation Wave for Hardening Around Bolt Holes in Rails

947D0008A Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 9, Sep 93 pp 15-18

[Article by I.A. Churyumova and S.G. Dovbysh, All-Russian Scientific Research Institute of Railroad Transportation; UDC 621.7.044:625.143.4]

[Abstract] A technology of local hardening has been developed for the purpose of increasing the fatigue strength of railroad tracks in the vulnerable zone of bolt holes, namely by treating the quenched high-carbon M76 steel (0.71-0.82% C) rail steel with a detonation wave. In the experimental stage shock waves were generated by detonation of friable explosives (cyclonite, ammonite) and plastic explosives (seismoplast), the fuse cord passing axisymmetrically through the center of the bolt for either unilateral or bilateral hardening. Hardening tests were performed on 600 mm long rail segments with one drilled bolt hole 65 mm in diameter. Subsequent fatigue tests were performed in a TsDM-200/400 hydraulic vibrator under a cyclic flexural load alternating at a frequency of 5 Hz with a 700 kN amplitude and a 0.1 asymmetry index. The test base for the endurance limit was $2x10^6$ cycles, cracking around the bolt hole in unhardened control specimens having begun already after $2x^5$ cycles. Metallographic examination was performed under an MIM-8 optical microscope and in a "Camebax" microanalyzer. An analysis of the results indicates that there does not exist a one-to-one dependence of the rail life on the thickness h and/or the microhardness H of the thus hardened layer, but that the fatigue strength depends inversely on the hardenining gradient G= dH/dh: more uniform hardening (smaller gradient) results in a higher endurance limit and thus a longer life of bolted rails. A set of metal in excess of 0.3% evidently causes both microcracking and macrocracking. Optimum hardening with minimum roughness of the hole edges was attained by simultaneous bilateral detonation of seismoplast with a fuse cord. Figures 5; tables 1; references 8.

Embrittlement of Pipe Fittings Made of 25Cr17Ni2Nb-Sh Ball Bearing Steel

947D0008C Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 9, Sep 93 pp 22-24

[Article by L.P. Karpov, "Electrochemical Apparatus" Combine; UDC 620.178.2:669.14.018.298]

[Abstract] Since pipe fittings 10-25 mm in diameter made from rods of 25Cr17Ni2Nb-Sh ball bearing steel (0.22-0.28% C, 16-17.7 % Cr, 2.3-2.8 % Ni, 0.05-0.1 % Nb, 0.30-0.7 % Mn, 0.30-0.70 % Si, ≤ 0.015 % S, ≤ 0.008 % P) for high-pressure conduits are being joined to the main by electrical brazing with a high-frequency current, it has been found necessary to determine the

causes of embrittlement during that process. Two kinds of specimens were prepared for the study: 1) smooth rods 6 mm in diameter with a neck 4 mm in diameter formed by cutting a notch; 2) smooth rods 6 mm in diameter without a notch. Some specimens of each kind were produced from blanks according to scheme A: heat treating the blanks by quenching from 980°C + tempering at 700°C, then machining them on the lathe with attendant formation of a cold-hardened layer. Other specimens of each kind were produced according to scheme B: machining annealed blanks on the lathe, then heat treating the finished rods by quenching from 1000°C under vacuum + tempering at 710°C. The initial hardness of all specimens was 31.8 Rockwell C. Also tubular specimens with a 15 mm inside diameter and a 5 mm wall thickness were prepared, according to scheme A. Mechanical tests and microstructural examination identified stress concentrators such as nonmetallic inclusions and cold-hardening as the causes of embrittlement. Simulation of the brazing process with inclusion of subsequent cooling in air or in a copper "refrigerator" revealed no anomalous changes in the impact strength and thus no temper embrittlement of specimens with a crack which had been quenched in oil and subsequently tempered to various hardness numbers within the 25-35.8 Rockwell C range. Overheating during brazing was, however, found to increase the degree of embrittlement almost linearly with rising temperature: from 2.6% at 755°C (A_{c1}) to 28.6% at 860°C (A_{c3}. Recommendations for abating embrittlement of pipe fittings made of this steel are: designing them with large fillet radii, producing them in accordance with scheme B, and brazing them on at temperatures not higher than 800°C. Figures 2; tables 3; references 2.

Changes in Structure and Properties of Austenitic Stainless Steel during Dynamic Recrystallization

947D0008B Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 9, Sep 93 pp 19-22

[Article by R.G. Zaripova, O.A. Kaybyshev, and G.A. Salishchev, Institute of Problems Regarding Superplasticity of Metals at Russian Academy of Sciences; UDC 669.14.018:620.17:620.186]

[Abstract] An experimental study of austenitic stainless steel 12Cr18Ni10Ti ($\leq$ 0.12% C, 17-19 % Cr, 9-11 % Ni, 0.8 % Ti)was made concerning its dynamic recrystallization under compression at high temperatures. Industrial specimens 15 mm long and 10 mm in diameter were loaded in an Instron machine while being heated by the SiC element of a laboratory furnace. The strain rate was varied over the 10^{-4}- 10^{-2} s^{-1} range in discrete 10 % steps. The temperature was varied over the T= 800-1000°C range, specimens being heated not longer than 10 minutes and sprayed with cooling water as the load was being removed. The sensitivity of the yield stress σ to change of the strain rate $d\varepsilon/dt$ was calculated as the ratio of $\log(\sigma_2/\sigma_1$ to $\log[(d\varepsilon/dt]_2/(d\varepsilon/dt)_1]$. The apparent energy Q of plastic flow activation was determined from the slope of the $\log(d\varepsilon)$ - 1/t diagram and the z-parameter was calculated according to the $z=(d\varepsilon/dt)e^{Q/RT}$ relation (Q= 495 kJ/mole, R- gas constant, T- temperature). Metallographic examination was performed in an "Epiquant" structure analyzer and the dislocation structure was examined under a JEM-2000EX emission electron microscope. The stress-strain curves indicate the existence of three "temperature - strain rate" regions characterized each by different recrystallization dynamics: In region A (T= 800-900°C, $d\varepsilon/dt > 10^{-3}$ s^{-1}) deformation is attended by softening after the yield stress σ has peaked under a ε= 20% strain. In region B (T= 900°C, $d\varepsilon/dt < 10^{-3}$ s^{-1}) the yield stress oscillates, the amplitude of its oscillations decreasing with increasing strain. In region C (T= 1000°C, $d\varepsilon/dt < 10^{-3}$ s^{-1}) the yield stress σ does not peak and the strain remains constant after hardening. The results indicate that the kinetics of microstructural changes during hot deformation of this steel depend on the mechanisms of the preceding deformations and particularly on the slip pattern. The parameters of the new structure formed in the process, namely its grain size and recrystallization volume, depend accordingly on the z-parameter characterizing the deformation process conditions in terms of temperature and strain rate: both parameters becoming larger when the z-parameter is increased. When z is very large and the number of slip patterns is limited, then strong local deformation takes place and dynamic recrystallization is effected by fragmentation of grains followed by fissure of the fragments. As the strain increases, the yield stress becomes more sensitive to change of the strain rate, dynamic recrystallization thus controlling the yield stress. Figures 5; tables 1; references 6.

METALS

Resistance of Pipes Made of PT-7M Titanium Alloy to Multicycle Fatigue

947D0012A Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 10, Oct 93 pp 32-34

[Article by Yu.D. Bondarenko, A.A. Reznichenko (deceased), and A.A. Usachev, Dagestan Polytechnic Institute; UDC 620.172.3:669.295.5]

[Abstract] Pipes made of the titanium alloy PT-7M (titanium plus 1.8-2.5 percent Al, 2-3 percent Zr, and 0.1 percent C) with a diameter of 13 mm and wall thickness of 1.5 mm were subjected to fatigue tests under a variable-sign load in a fixed plane on resonance-type units with electromagnetic excitation of vibrations. During the testing each pipe was bent like a beam on two supports under the effect of a running inertial load, inertia forces, and inertial moments of additional weights attached on its brackets. The span of each test pipe segment measured 520 mm, and the gradient of the bending moment on the section of likely fracture (about one-fourth of the span) did not exceed 0.1 percent/mm of the bending moment in the midsection. A loading frequency of 100 Hz, a symmetrical cycle with a constant deformation amplitude, and a test base of 10^8 cycles

were used. The error in measuring the deformation amplitudes did not exceed +/-5 percent, and the temperature regimen conformed to the requirements stipulated in state standard GOST 25.502-79. Fifteen series of 15 specimens were tested. The titanium alloy's notch sensitivity was found to increase somewhat as the temperature increased. At T = 20°C, the effective notch-sensitivity index concentration K_{eff} equaled 2.53 versus 3.13 and 2.77 at T = 250 and 350°C, respectively. An average value of K_{eff} = 2.81 was assumed. (The maximum value of the theoretical notch-sensitivity for a stretched wafer of linearly elastic material is K_{eff} = 3.) As the temperature was increased, the titanium alloy pipes' "sensitivity" to absorption of hydrogen (relative decrease in σ_{-1} as the hydrogen content increases) decreased. It was suggested that the test results summarized in table form be used to estimate the lifetime of equipment containing pipes made of PT-7M titanium alloy by hypothesizing the linear summation of instances of fatigue. Figures 2, table 1; references 5 (Russian).

Multicomponent (Ti, V, Cr) Nitride Coatings Deposited from Ion Plasma

947D0007A Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 9, Sep 93 pp 10-12

[Article by R.Kh. Saydakhmedov, M.G. Karpman, and G.P. Fetisov, Moscow Institute of Aviation; UDC 621.793.184:669.14.018.252.3]

[Abstract] Specimens of R-6Mo5Co5 high-speed cutting tool steel were coated by the ion-plasma process with Ti, V, Cr nitrides and various combinations of them, the process involving condensation from the plasma phase with attendant ion bombardment. Deposition of titanium nitride coatings was preceded by preliminary deposition of titanium on the steel surface. Subsequent processing was done with the steel substrate at a temperature within 550+/-25°C and the nitrogen pressure within 0.25-0.28 Pa, with the bias potential held constant at 100 V and the current varied over the 75-125 A range. The phase composition of the coatings was analyzed in a DRON-3M x-ray diffractometer with Cu-K_α and Co-K_α radiation sources, the results revealing the presence of 0.02-1.0% Fe,Mo,Co,W,Si from the steel. An x-ray structural examination revealed, moreover, not only TiN with a b.c.c. crystal lattice (parameter a= 0.4241 nm) but also up to 8% α-Ti phase which had formed during the preliminary deposition of titanium. An x-ray spectrum microanalysis was performed with an electronic probe in a "Cam-Scan" analyzer. The relative nitrogen content in the coatings was measured using a $TiN_{0.06}$ reference specimen. The coatings were tested for abrasion resistance in dry sliding friction, a 2500 m long path being covered at a velocity of 1.1 m/s and the amount of wear being measured by the loss-of-mass method. The heat resistance of coated steel was estimated from the change of mass as specimens were soaking in air at 600°C. Microbrittleness of the coatings was measured with a PMT-3 microhardness tester, the ratio of indentations with cracks to the total number of indentations being thus estimated and the behavior of cracked indentations being tracked as the load was increased from 0.196 N to 1.96 N. Examination of chromium nitride coatings revealed 74% Cr_2N and 26 % CrN, also traces of chromium which had formed a 0.4 μm thick underlayer after its preliminary deposition. Examination of vanadium nitride coatings revealed traces of vanadium accompanying the principal phase VN with a b.c.c. crystal lattice (parameter a= 0.4123). Coatings of (Ti+Cr) nitrides were found to have a b.c.c. crystal lattice and a nonstoichiometric composition corresponding to $(Ti,Cr)N_{0.47}$: isomorph of TiN and CrN mononitrides rather Ti and Cr dinitrides, despite the low (32 atom%) nitrogen content. Coatings of (V+Cr) nitrides consisted of 79-80% $(V,Cr)_2N$ and 11-21% (V,Cr)N, both phases having a b.c.c. crystal lattice. The results of mechanical tests indicate that these coatings have a higher heat resistance and a higher wear resistance than TiN and (Ti,Cr) coatings, also when deposited on Ti-W 22 titanium alloy and on 12Cr18Ni10Ti steel. Figures 2; tables 2; references 3.

Methods Currently in Use for Intensification of Hydrometallurgical Processes

947D0004A Moscow TSVETNYYE METALLY in Russian No. 9, Sep 93]

[Article by A.S. Medvedev and B.G. Korshunov, Moscow Institute of Steel and Alloys; UDC 669.053.4: 669.2/8]

[Abstract] Methods of intensifying hydrometallurgical processes currently used in the nonferrous industry and unconventional methods of accelerating lixivation of raw minerals are reviewed on the basis of recent research done at the Moscow Institute of Steel and Alloys. As the point of departure is considered the classical relation $da/dt = (+/-)KC^nS$ (a- degree of conversion, t- time, S- area of interphase boundary, C- concentration of reactant of component, n- order of process with respect to reactant or component, $K = Ae^{-E/RT}$- empirically determined process rate constant, E- activation energy, R- universal gas constant, T- temperature, A- coefficient) describing lixivation, crystallization, cementation, and ion exchange processes. Use of γ-radiation from sources such as ^{60}Co or ^{137}Cs for radiolysis of water intensifies oxidation-dissolution of uranium and its use for electrolysis or photolysis of Eu salts (sulfate) intensifies reduction-precipitation for separation of Eu from other rare-earth elements. Ultrasonic processing of ionite intensifies ion exchange. Ultrasound is also used for completing lixivation of Pb cake by dissolution of Zn,In,Cd admixtures and for overcoming barriers which limit chemical reactions such as A(solid) + B(in solution) → C(solid) + D(in solution) by limiting internal diffusion through solid product layers. A simpler new method of overcoming these barriers during lixivation of ores and concentrates has been proposed by the authors, namely implantation of additives in the pulp which will act as crystallization centers. Such an additive should contain

calcite or preferably dolomite for lixivation of scheelite with soda in an autoclave, or tungstic acid (powder) for decomposition of scheelite with nitric acid. Lixivation of Pb cake and of concentrates with more precious contents is also being intensified by mechanical activation: in centrifugal planetary grinding mill with drums which rotate both about their common axis and in the opposite sense about their own axes. Modification of minerals such as wolframite → scheelite during comminution is being intensified either by mechanochemical activation, namely addition of a calcium salt, or by thermal activation into the phase-transformation range and subsequent quenching. Cementation of metals such as Cd and Cu is being intensified by mechanical activation in a continuous-action vibratory reactor. Figures 5; bibliography will be included in next part of this article.

Plasma Formed by Interaction of Laser Radiation and Solid Targets

947J0011A Moscow USPEKHI FIZICHESKIKH NAUK in Russian Vol. 163 No. 12, Dec 93 (manuscript received 17 Jun 93, after completion 28 Sep 93) pp 51-84

[Article by V.S. Vorobyev, Institute of High Temperatures at Russian Academy of Sciences, Moscow]

[Abstract] Research done during the 1969-1991 period concerning the physical mechanisms of laser-induced plasma formation above solid targets is reviewed, formation of low-temperature surface plasma by interaction of laser radiation and solid targets covering the 10^5-10^{10} range of radiation intensity being essentially considered here along with negative and positive technological aspects of the process. The results of experiments with pulsed CO_2-lasers indicate that formation of a plasma above metal surfaces in air requires a radiation of only about 10 MW/cm^2 intensity in pulses of about 1 μs duration and of only 0.1-1 MW/cm^2 intensity in millisecond pulses, while breaking down air in the absence of metal surfaces requires as much as 1-10 GW/cm^2. Two characteristic target temperatures have been defined as parameters of the initial thermal interaction: temperature T^* of complete vaporization and temperature T_b of boiling or sublimation under a given pressure of the ambient gas. The energy relations during thermal stage of target heating to vaporization and the subsequent stage of vapor ionization are examined theoretically with the support of experimental data, for the purpose of determining the threshold laser radiation intensity and the threshold energy density at the target surface. Inasmuch as both threshold depend on the mode of surface plasma formation, the following ones are considered here: S- by heating of the entire target surface, MD- by heating of thermally insulated microdefects, A- by heating and vaporization of aerosol, VGM- by ionization of the target vapor mixed with ambient gas in the diffusion mode, EF- hydrodynamically in the presence of an erosion flare. The review covers plasma formation in these modes above ideally smooth surfaces of many metals ranging from fusible ones (Zn,Pb) to refractory ones (W,Ta) including brass, also of carbon and several oxides (alumina, silica), above surfaces of nonhomogeneous materials such as aluminum alloys with solid inclusions of intermetallic compounds, above microdefective surfaces, and above rough surfaces. Analysis of surface plasma formation in vapor-gas mixtures in the diffusion mode after heating of the entire target surface (S-VGM) are considered two models: quasi-steady vapor distribution within a cloud of finite dimensions and nonsteady vapor distribution within a cloud in statu nascendi, atomic and molecular ambient gases being considered. Analysis of surface plasma in the hydrodynamic mode in the presence of an erosion flare is based on the model of vapor breakdown by a "heat absorption spike" or the model of "avalanche ionization" in gas layers at the target surface. Despite the subjectivity of researchers and not always consistent research data, the thresholds of surface plasma formation by laser radiation pulses have been in many cases correctly estimated. Figures 15; tables 5; references 155.

Scientific Conference on 30 December 1992 by Department of General Physics and Astronomy of Russian Academy of Sciences

947J0011B Moscow USPEKHI FIZICHESKIKH NAUK in Russian Vol. 163 No. 6, Nov-Dec 93 pp 85-88

[Article by member of editorial staff]

[Abstract] A scientific conference was held on 30 December 1992 by the Department of General Physics and Astronomy of the Russian Academy of Sciences at its Institute of Problems in Physics imeni P.L. Kapitsa. Three lectures on the topic of femtosecond pulses and their usefulness in physics were given:

1. "Current Trends in Research on Femtosecond Pulses and Possibilities of Their Use in Experimental Studies Pertaining to Nonlinear Quantum Electrodynamics" by P.G. Kryukov;
2. "Nonlinear Propagation of Femtosecond Pulses Through Fiber-Optic Waveguides" by Ye.M. Dianov, A.M. Prokhorov, and V.N. Serkin;
3. "Generation of Ultrahigh-Intensity Optical Fields by Powerful Femtosecond Laser Systems Including Excimer-Laser Amplifiers and Experiments Relating to Emission of Ultrashort X-Ray Pulses" by V.M. Gordiyenko, N.I. Koroteyev, and V.T. Platonenko.

In this report is summarized the content of the third lecture, which relates to development of "desktop" terawatt lasers emitting femtosecond radiation pulses of only 0.01-1 J energy. The mechanism of the process includes "inertial conservation" of the laser-induced plasma during its expansion, heat transfer deeper into the target mainly by diffusion being the main factor which limits the plasma temperature. When the radiation intensity exceeds the 10^{18}-10^{19} W/cm^2, then light pressure exceeds thermodynamic pressure while the plasma temperature climbs to thousands of electron-volts and the electron concentration reaches 10^{23}-10^{24} cm^{-3} under pressures of 10-100 Mbar. Under these conditions the motion of free electrons shifts into the relativistic mode, which imparts unique properties to a femtosecond surface plasma so that it becomes a new object of basic research. This applies particularly to the electrodynamics of interaction of high-intensity radiation and a rapidly expanding steep high-temperature plasma front, also to the emission of x-rays by such a plasma. The laser facility built at the Moscow State University under the late S.A. Akhmanov includes solid-state visible lasers with a 1-10 GW power rating and an molecular XeCl excimer laser with a 10-100 GW power rating which emit 570-630 nm radiation and 308 nm radiation respectively, in pulses of about 40 fs duration. Proper focusing makes attainable a radiation intensity even higher than 10^{16} W/cm^2 at the target surface.

Owing to the low optical density of a surface plasma, most of its x-ray emission energy lines within the resonance lines of its ions. With the aid of multilayer resonance mirrors it therefore becomes possible to extract strong narrow-band x-ray pulses and especially so from plasmas with hydrogen-like or helium-like ions. Theoretical analysis of the x-ray emission mechanism indicates that thin-film targets of about 100 nm thickness form laser-induced plasmas which make effective sources of hard x-rays. In this the heat is retained at the target, because the dissipation mechanism is inactive here, so that a less than usual intensity of the "heating" laser beam will be adequate. References 7.

Deuterium State and Probability of Cold Nuclear Fusion in Solid

947J0012A Tomsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: FIZIKA in Russian No. 10, Oct 93 pp 20-30

[Article by V. S. Demidenko and V. I. Simakov; UDC 539.172.13/16]

[Abstract] Computations of the potential of a deuteron and the probability of the reaction of cold nuclear fusion of deuterium in the compound TiD_2 and in its alloys with elements of a 3d-period were made. The role of diffusion and phase processes in the synthesis of deuterium nuclei is statistically interpreted. On this basis a method is proposed for examining the state of a deuteron in a solid, making it possible to define a number of aspects which must be taken into account in subsequent research. In itself the solid is a significant factor reducing the Coulomb barrier of the deuteron. The screening effect itself is stable relative to the change in composition and external hydrostatic pressure, but does not ensure the probability of nuclear fusion even at the Jones level. Results are given providing a basis for assuming that the high mobility of deuterons in a solid, the band character of their motion and the active response to external fields are together capable of ensuring the necessary orders of the reaction rate. The formulation of a uniform model of cold nuclear fusion must therefore be based on the combined screening of d-d interaction under conditions when nonequilibrium processes prevail. Particular attention must be given to directed fluxes of deuterons along definite crystallographic directions for which resonance interaction effects are possible. The appearance of experimental data on buildup as a result of the cold nuclear fusion reaction of helium and tritium indicates that a solid also may exert an influence on the nuclear reaction mechanism itself. It is possible that a definite role in this case is played by steep gradients of electric fields already measured, for example, for palladium hydride. References 32: 16 Russian, 16 Western.

Direct Thermonuclear-to-Electric Energy Conversion in Dragon Trap

947J0013A Moscow FIZIKA PLAZMY in Russian Vol. 19 No. 12, Dec 93 (manuscript received 5 May 93) pp 1418-1425

[Article by V.M. Glagolev (deceased) and A.V. Timofeyev, Russian Science Center "Kurchatov Institute"; UDC 621.039]

[Abstract] Recuperation of the plasma energy in fusion reactors by direct thermonuclear-to-electric energy conversion is considered, a method of connecting the recuperator trap to a closed dragon trap being proposed which is simpler than the conventional use of a bundle diverter. The recuperator is a curvilinear adiabatic trap which contains a mirror machine identical to those in the dragon trap. The method of connecting the two traps utilizes the peculiarities of plasma diffusion within the dragon, the latter confining three groups of charged particles: 1) drift particles in its toroidal segments, 2) "superbanana" particles confined between locks in its curvilinear collision-radiative electron lenses, 3) particles confined in its axisymmetric mirror machines. The key to the proposed method are the different modes of their diffusion, those restrained in a mirror machine diffusing in the classical mode across the magnetic field while drift and "superbanana" particles setting in the toroidal dragon segments diffuse in the neoclassical mode. Diffusion of electrons and of ions is analyzed quantitatively according to theory. The relevant plasma parameters are evaluated on the premise that the frequency of ion-ion collisions is always lower than the frequency of electron-electron collisions owing to heavier mass of ions. A recuperator has two electrodes mounted one at each end for extraction of electric energy. The confining magnetic field is the one between the electron lenses in the dragon. During the recuperation process charged particles become quickly confined in the mirror machines of the dragon and are drifting here in crossed fields from the center of the dragon outward. Recuperation requires that particles have more energy for l longitudinal motion than for transverse motion, in which case "superbanana" particles in the mirror machines become converted into drift particles. These are then recuperated by means of electrodes inserted into the locks of the mirror machines, relocating the electrodes into these locks from locks in the electron lenses having simplified the device and reduced its size. The particularly important initial stage of the recuperation process is analyzed on the basis of two equations, one relating the rate of change of kinetic energy to the

electric potential gradient and one representing the law of magnetic momentum conservation. Separately is considered rotational conversion of energy and its effect on the recuperation process, whereupon an approximate expression is derived for the efficiency of recuperation in such a system. The authors thank V.V. Arsenin, I.N. Golovin, and V.D. Shafran for discussion. Figures 2; references 7.

Mathematical Simulation of Action of Ion Beams Breaking Down Metal Targets

947J0015A Moscow TEPLOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol. 31 No. 6, Nov-Dec 93 (manuscript received 22 Dec 92) pp 897-902

[Article by V.V. Kostin, V.A. Skvortsov, and V.Ye. Fortov, Institute of High Temperatures at Russian Academy of Sciences, Science Department; Moscow; UDC 539.124]

[Abstract] Breakdown of metal targets by high-intensity ion beams and the dynamics of stressed state formation in targets during their bombardment by proton beams are analyzed by mathematical simulation. Interactions of high-intensity ion beams and target material not resulting in high-temperature heating of the plasma corona are considered so that preheating of the target can be disregarded. Correspondingly is considered interaction of high-energy (about 10 MeV) proton beams incident on solid targets in short pulses of up to 100 ns duration. The nonsteady flow of target material under an incident high-intensity ion beam is calculated in the hydrodynamic approximation in accordance with the three applicable integrodifferential equations of mass, momentum, and energy conservation. The elastoplastic characteristics are evaluated in accordance with the Mises model. The simulation program includes a two-dimensional "flow of continuous medium" algorithm in Lagrangian coordinates, constructed according to the explicit "cross" scheme and involving the "predictor-corrector" procedure of second-order precision. Oscillations of nonphysical quantities are prevented by insertion of an artificial viscosity into both tensor and scalar forms. The breakdown model is based on the kinetic description of crack formation as a defect buildup process and attendant weakening of the material, the system of its equations being closed by an equation of state which covers not only a large class of materials but also wide temperature and pressure ranges up to extremely high ones. The deformation resistance increases with increasing intensity of the compression shock and reflection of the latter gives rise to a rarefaction wave, the tensile stresses in latter disrupting the continuity of the material. Numerical calculations on the basis of this model have been made for an aluminum target and two different high-intensity ion beams delivering the same total energy to the target: 1) thin tubular beam about 0.5 mm wide with the maximum current density at the 1 mm radius, 2) solid cylindrical beam with a Gaussian radial distribution of the current density peaking at the 0.5 mm radius. For simplification, the kinetic energy of protons is assumed to remain constant at the 10 MeV level over the duration of an incident pulse. An important parameter included in the calculations is the strain rate characterizing the response of a target to an incident shock wave. The results indicate that both the evolving stressed state of a target and the degree of its breakdown depend largely on the configuration of the focal radiation spot, a tubular beam producing defects over a larger target area. A high-energy proton beam evidently forms a large region of lower-density material surrounded by higher-density condensate, both temperature and pressure in this region rising appreciably within the Bragg peak deeper inside the target. Figures 5; references 27.

Numerical Stability Analysis of Boiling Coolant in Heated Parallel Channels

947J0015B Moscow TEPLOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol. 31 No. 6, Nov-Dec 93 (manuscript received 16 Oct 92) pp 934-940

[Article by B.I. Nigmatulin. V.N. Blinkov, O.I. Melikov, and P.G. Gakal, Elektrogorsk Scientific Testing Station; UDC 532.529.5]

[Abstract] The flow of a boiling coolant through parallel heat exchanger channels in a reactor core is analyzed for stability on the basis of the 1P2T1W (P-pressure, T-temperatures of liquid and vapor respectively, W-velocity). The equations of this mathematical model are one-dimensional first-order partial differential equations describing the flow of kinetics of a two-phase stream including its one-phase segment and the laws of mass-energy-momentum conservation in such a channel with appropriate boundary conditions. These equations are integrated numerically by the method of finite differences, the four sought variables being: pressure, temperature of the liquid, velocity of the stream, and the volume fraction of vapor. Friction at the channel walls is described by simple correlations for a homogeneous liquid, as a function of the Reynolds number. The interphase heat transfer is assumed to be sufficiently intense for disregarding the small thermal unbalance between the phases. The boundary conditions are: constant pressure at the outlet; given temperature and flow rate of entering coolant. Both bubble boiling and film boiling during the flow are considered, the boundary between both modes in the stream being defined in terms of the critical heat flux as a function of the mass fraction of vapor within its subcritical range. Calculations made without applying the Courant condition reveal an onset of instability and its subsequent evolution by a mechanism associated with heat load changes under a constant pressure head and the consequences thereof. As stabilizing factors are identified friction at the wall and heat transfer from it to the entering one-phase stream segment. The combination of these factors with thermal inertia of channel wall, hydrodynamic losses due to flow rate and attendant density perturbations as well as due to friction and internal drag within the two-phase stream segment will determine the flow dynamics. The adiabatic one-phase stream segment is replaced with an equivalent

hydrodynamic drag element. Both heated and two-phase stream segments are subdivided into equally thick discrete slices. The calculations have been made for an actual system with a circulation pump and six parallel identical parallel heat exchanger channels between a common collector followed by six throttles and a common separator for preceded by six throttles, the coolant flowing as follows: 1. liquid entering the collector, 2. liquid-vapor mixture entering the separator, 3. liquid alone returns to the pump after passage through the heat exchanger. The stabilizing effect of a digital Bernoulli flow rate meter on the inlet side has also been evaluated, on the basis of calculation of the flow rate as a function time with and without such a device in the circulation loop. Figures 6; references 24.

Heat Radiated by Turbulent Jets and Recorded Through Atmosphere

947J0015C Moscow TEPLOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol. 31 No. 6, Nov-Dec 93 (manuscript received 13 Apr 93) pp 962-966

[Article by V.P. Kabashnikov, N.V. Kuzmina, A.A. Kurskov, and G.I. Myasnikova, Institute of Physics at Byelarusian Academy of Sciences, Minsk; UDC 535.231.4:532.517.4]

[Abstract] A problem in recording, with a receiver on ground, the heat radiated by turbulent jets of gaseous molecular combustion products in space upon its passage through a turbulent atmosphere is the effect of atmospheric fluctuations on readings. This effect is evaluated theoretically on the basis of the Reardon multigroup model by a method which takes into account the contribution of "hot" lines. In that model lines within some region of the spectrum are replaced with groups of lines differing only in their excitation energy levels, which are multiples of the ground-state vibrational quantum in molecules of the gas. The mean radiation intensity within a finite range of the spectral band characterizing the gas is, in the case of Lorentz broadening of spectral lines, calculated by representing the one-point probability density distribution functions as superpositions of three δ-functions. Such calculations have been made for a jet of a gaseous $H_2O + CO_2 + CO$ mixture with the respective partial pressures 0.041 atm, 0.033 atm, 0.003 atm and the temperature 850 K at the throat of a 20 cm in diameter nozzle. The results indicate that in the case of H_2 and CO_2 combustion products turbulent atmospheric temperature and density fluctuations must be accounted for in the Wien region of the radiation spectrum. The effect of these fluctuations on the emitted radiation is strongest where their amplitude is largest and where the jet temperature is approximately twice the ambient one, typically at the jet edges and in the transition segment. Tables 3; references 25.

Diagnostic Glass Targets With Europium Admixture for Laser-Driven Fusion

947J0017A Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No. 6, Nov-Dec 93 pp 141-144

[Article by V. I. Dolgopolov, A. A. Druzhinin, V. M. Izgorodin, V. N. Ilyushechkin, M. Yu. Maksimov, S. P. Martynenko, Ye. F. Medvedev and V. L. Sumatokhin; UDC 621.039.633]

[Abstract] The technology and characteristics of glass diagnostic targets with a Eu admixture are described. The superiority of Eu for this purpose over other alternatives is discussed. The targets are intended for the calibration of a collector in measurements of the product of the density of a compressed target and its radius in experiments with laser-driven fusion. The apparatus and procedures for preparing the glass microspheres used in this work are examined and the necessary qualities of these microspheres are defined. A combination of Eu in the forms Eu_2O_3 or $Eu(NO_3)_3$ with citric acid was selected for the production of microspheres 100-250 μm in diameter with a wall thickness 0.5-2 μm. The parameters and procedures for microsphere irradiation are given. The necessity for a uniformity of Eu distribution in the glass of each microsphere is stressed. It was found that the introduction of Eu into a solution of liquid glass in the form of a citrate complex makes it possible to fabricate microtargets from glass with acceptable geometric parameters. Adequate concentrations of Eu and the uniformity of its distributions make these targets suitable for use for diagnostic purposes in experiments with laser-driven fusion. Figures 2; references 7: 4 Russian, 3 Western.

Flicker Noise in Radio-Frequency SQUIDS Built With High-Temperature Superconductors

947J0014A St.Peterburg ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol. 63 No. 5, May 93 (manuscript received 25 Mar 92, final version 16 Jul 92)

[Article by Yu.M. Galperin, Institute of Engineering Physics imeni A.F. Ioffe, St.Peterburg; 01;05;09]

[Abstract] Noise in SQUIDS built with high-T_c superconductors and operating at radio frequencies is analyzed, of specific concern here being the effect of flicker fluctuations of the critical current in the nonlinear Josephson junction on the 1/f noise in such a SQUID and the dependence of its spectral density on the mode of SQUID operation. The interferometer is inductively coupled to a LC oscillator-pump tank circuit with a shunting resistance R. The analysis is based on four equations: 1) one for the magnetic flux in the interferometer, which consists of a signal flux and an "external" flux; 2) one for the Josephson current, which consists of a fluctuation component and a supercurrent in addition to the $(h/2eR)\varphi$ current (h- Planck's constant, e- electron

mass, R- oscillator resistance, φ- total magnetic flux normalized to a flux quantum, displacement current negligible at low frequencies; 3-4 oscillator equations for the voltage across it and the total current in it respectively. Inasmuch as the inductance of a SQUID is usually very low, its static $\varphi(\varphi_{ext})$diagram is calculated on the basis of the threshold model (K.K. Likharev; Introduction to Dynamics of Josephson Junctions, Izd. Nauka 1985), which includes a hysteresis loop consisting of linear segments, whereupon the performance of such a SQUId is analyzed again for noise, this time taking into account that hysteresis. Figures 3; references 17.

3-D Potentials Method in Modeling of EM Fields in Quasi-Stratified Media

947K0062 Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA: VYCHISLITELNAYA MATEMATIKA I KIBERNETIKA in Russian No. 4, Oct 93-Dec 93 (manuscript received 1 Jun 93) pp 30-40

[Article by V. I. Dmitriyev, S. P. Falaleyev, Laboratory of Mathematical Physics of the faculty of Computational Mathematics and Cybernetics; UDC 519.6:517.958]

[Abstract] This article develops a numerical algorithm to model electromagnetic fields (magnetotelluric sounding) in quasi-stratified media using three-dimensional potentials. The quasi-stratified medium is considered to be a conducting structure consisting of homogeneous layers of variable thickness. Outside the local anomalous area the medium is a plane-parallel stratified medium with a normal electric conductivity distribution. When the algorithm is used in magnetotelluric sounding, the impedance of the field at the Earth's surface is measured over a wide range of frequencies. Thus, the electrodynamic problem must be solved for a large number of wavelengths, which takes a great deal of processor time. A method is presented to reduce this by a factor of five. The algorithm is written in FORTRAN 77 for an IBM PC/AT computer. Figures 2; references 14: 10 Russian, 4 Western.

Controlling Detection Equipment Scanning in the Target Search and Detection Mode

947K0041A Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian No. 9, Sep 93 pp 24-28

[Article by L. F. Vasilevich, S. A. Yezhov; UDC 621.396.965]

[Abstract]An optimum means is proposed to control how a search zone is scanned when detecting and tracking the trajectory of an individual target when a priori information on the type of target is available. The computations which were carried out showed that a 20-30% savings in search time is obtained as compared to sequential scanning for typical radar stations. This value grows proportionately to the number of cells in the search zone. 3 figures and 3 references.

Controlling Radar Observations Based on the Informational Criterion

947K0041B Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian No. 9, Sep 93 pp 64-66

[Article by I. A. Morozov, Yu. V. Snytkin; UDC 621.396.965:621.391.26]

[Abstract]Control using the information function involves a ratio analysis after each observation interval in order to determine the component amount of information which can provide the greatest increase when the controlling parameter values are next selected. This means a practical selection of a detection mode (detection, tracking, identification) and of controlling parameter values which can be changed in real time. When the loss function is not specified, control can be found and satisfactory results can be obtained using an approach based on maximizing the increase in the amount of information at each step. 1 figures and 2 references.

Property of Using Signal Group Classification Method during Direction Finding of Broad Band Sources

947K0041C Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian No. 9, Sep 93 pp 67-70

[Article by E. A. Maltsev; UDC 621.396.96]

[Abstract]An experiment is conducted to determine the directions from which broad band signals arrive when the data recording time is short in duration. It was shown that when the number of affecting sources is exceeded by the dimensions of the signal subspace, this leads to a significant deterioration of resolution of the signal group classification method. An efficient procedure of direction finding is proposed for the indicated conditions. 3 figures and 3 references

Prospects for Using Solid-State Active Devices of Extremely High Frequencies

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian No. 10, Oct 93 pp 29-34

[Article by Yu. P. Vorobyev, M. A. Dedunovich; UDC 621.396.967]

[Abstract]Techniques are described for analyzing and designing solid-state active devices within a systems approach. Some engineering solutions are examined, as well as attainable parameters for modern Hanna diode generators and frequency generators in the shortwave portion of the millimeter range ($\lambda = 2$ mm). It was found that the field of solid-state active devices of extremely high frequencies is a broad one because the devices are small in size, and require little energy. In particular this applies to their use for radar stations. 1 figure and 5 references.

Ratios between Power Dissipated and Absorbed by Antenna when Exposed to Radiation from Opposite Directions

947K0042A Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian No. 9, Sep 93 pp 41-47

[Article by V. E. Ankudinov, P. N. Fedorov; UDC 621.396.67.01]

[Abstract]Ratios are examined between the power that is dissipated and the power that is absorbed when a random conducting antenna loaded with a matched load is irradiated from opposite directions. It was shown that with a random aspect to the radiation and polarization of the falling wave, the total dissipated power is always more or equal to that absorbed when the antenna is radiated from the opposite direction by a planar electromagnetic wave with coinciding polarization and amplitude. Moreover, depending on the nature of the load which ensures a minimum effective scattering cross-section, antennas can be classified into three categories. In addition, an example of an antenna which provides identical reception from any two directions is a thin rectilinear dipole antenna. Unlike a rectilinear dipole, the majority of antennas have unsymmetrical directivity patterns. 2 figures and 8 references.

A Study of Metal-Oxide Heterostructure Films on the Aluminum Surface Using the Moessbauer Effect

947K0032EE Novosibirsk AVTOMETRIYA in Russian No. 4, Jul-Aug 93 pp 97-101

[Article by T. M. Tkachenko, V. G. Shadrov, E. A. Vasilev, A. V. Semeshko, A. V. Boltushkin, Ya. D. Komarovskaya; UDC 620.197:669.71:546.7]

[Abstract] Film metal-oxide heterostructures are widely used with different electronic devices. In order to develop carriers for a vertical magnetic recording, magnetic films based on metal oxide heterostructures on aluminum surface have been intensely studied for the last several years. The magnetic medium with a perpendicular magnetic anisotropy is realized in these film systems by formation of cell structures with distributed needle- like particles of ferromagnetic metal. The Moessbauer effect offers great potentials for studying these films. The objective of this study was, by applying the Moessbauer effect, to obtain information on the kinetics of the process of filling the cells, or pores, and information about the magnetic condition of needle- like particles. The film metal-oxide heterostructures were produced by electrochemical sedimentation of iron in the pores of the anode oxide film, formed on the aluminum surface by anodizing in the sulfuric acid electrolyte. The results of Moessbauer measurements demonstrated that magnetic and non-magnetic components were present in the spectra of all examined samples. The studies also indicate that by an appropriate selection of the anodizing condition and consecutive sedimentation on the aluminum surface, magnetic films, suitable for application in devices with a vertical information recording method can be obtained.

Transmission and Reconstruction of Wide-Aperture Three- Dimensional Images by the Method of Scene Scanning

947K0032BB Novosibirsk AVTOMETRIYA in Russian No. 4, Jul-Aug 93 pp 83-86

[Article by A. P. Yakimovich; UDC 621.397.13]

[Abstract] A method for transmission and reconstruction of three-dimensional wide aperture images is examined. The essence of the method lies in obtaining three-dimensional coordinates, brightness and spectral characteristic of object's points, aperture of their visibility window and eventual reconstruction of a three-dimensional picture as a totality of the object's points, where each of them is visible only from its own visibility window. This method allows to transmit high quality wide-aperture three-dimensional images without significantly increasing the bandwidth of the standard TV communication channel. This method can be employed with any methods of point- by-point scanning or monitoring the scenes. In this article the method of horizontal cross sections is examined because, compared to other, it requires a minimal bandwidth of the communication channel for the information transmission. The optical diagram for a possible implementation of the examined method is provided. Figure 1, references 9: 5 Russian. 4 Western

Functional Features of Multilayer Magnetic Spatial-Light Modulator with Prism Design

947K0043A Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian No. 10, Oct 93 pp 45-50

[Article by V. G. Vishnevskiy, Yu. F. Vilesov, N. A. Groshenko, V. F. Lamekin, A. V. Yarygin; UDC 535.42;621.397]

[Abstract]A description is given of a spatial-light modulator based on magneto-optical epitaxial films of iron-garnet with planar anisotropy. The impact which a dielectric mirror has on the intensity distribution in a spectral plane is also described. The dielectric mirror, which possesses polarization selecting properties, allows single pass magneto-optical diffraction to be achieved. 2 figures, 1 table and 10 references.

Method for Differentiation of Experimental Data

947K0032II Novosibirsk AVTOMETRIYA in Russian No 4, Jul-Aug 93 pp 113-117

[Article by M. Yu. Katayev, A. A. Mitsel; UDC 517.518.8]

[Abstract] Differentiation of an empirical function specified on a grid $a=x_1<x_2<...<x_n=b$ is incorrectly stated by its measured values $f(x_i)$, $i=1,...,n$. The incorrectness of the differentiation problem is related to violation of the third correctness condition according to Adamar - the stability condition. Several methods are used for the solution of this problem, including the Tikhonov method where the differentiation problem is reduced to the solution of the Fredholm equation of the first kind. With these methods a stable solution is numerically determined from the system of linear algebraic equations. An analytical solution of smoothing out and differentiation of empirical data is obtained in this paper and the results of numerical experiments are provided. References 10: 9 Russian. 1 Western.

Fourier Transform of the Beam Data

947K0032HH Novosibirsk AVTOMETRIYA in Russian No. 4, Jul-Aug 93 pp 110-112

[Article by O. Ye. Trofimov; UDC 517]

[Abstract] Integrals of function $f(x_1,...x_n$ along straight lines are called beam data. If n=2, the beam date correspond with the Radon transform ; this case is characteristic for classical computer X- ray tomography. Methods of 3-D (n=3) or even 4-D (n=4), the fourth coordinate can be time or wavelength with the tomography in the optical range. Reconstruction of function f(x) from its beam data is the 3-D reconstruction problem. This problem is meaningful

for any type of tomography. Equations are provided for computing the Fourier transformation of uniform, generalized functions in a three-dimensional space. These formulae allow to construct effective numerical algorithms of tomographic 3-D reconstruction from the beam data. References 10 Russian.

Geometrical Aberrations of a Quasi-Planar Lightguide

947K0032FF Novosibirsk AVTOMETRIYA in Russian No. 4, Jul-Aug 93 pp 102-106

[Article by S. V. Mikhlyayev; UDC 535.317:681.7.012]

[Abstract] Geometric aberrations of a lightguide because of a nonparallel orientation of its walls have been examined. The lightguide consists of a transparent medium bound by two planes. The lower plane coincides with the XY plane, the Z axis is directed normal to this surface. The upper plane is oriented at an angle to the lower, so that it intersects planes ZY and ZX at angles α and γ. The incident light beam lies in a plane x=constant, and forms an angle β with the normal to the lower plane. If the walls are not parallel, when α and β are not equal to zero, geometric aberrations are produced, which are deviations Δx_i, Δy_i of the coordinates of the beam intersection points with the lower plane from their value, compared to the ideal case. Computations of Δx, [Dy] as a function of the number of reflections N for different values of parameters α and γ were made and the results are shown in the graphs. Cases of the light beam propagation through a quasi-plane light guide and a case of the coordinates deviations Δx, Δy from N because of the light beam divergence were also examined and the results are provided. Figures 11, references 6: 1 Russian, 5 Western

Ukranian Communications Minister Discusses Telecommunications Policy

947K0037B Moscow VESTNIK SVYAZI in Russian
No. 6, Jun 93 pp 10- 12

[Article by O. Prozhivalskiy]

[Text]Today, the Ukraine possesses a sufficiently high economic potential. It has well-developed industry, fertile lands, and many mineral resources. Unfortunately, the communications industry in the old centralized economic management system was financed on what was left over. As a result, telephone density in the Ukraine today comprises 16 telephones per 100 inhabitants, which is almost three times lower that the optimal telephone level. We also lag in the numbers of radio broadcasting and television programs which the population of the country needs for transmitting data at great speeds.

For the Ukraine to become a state and for its economy to be revived, accelerated development of communications equipment is needed, especially telecommunications equipment. In order to bring the industry up to date and overcome the backwardness which has accumulated for many years, the Ukrainian Communications Ministry has developed a National Communications Development Program to the year 2005.

The main goal of the program is to accelerate the development of telecommunications networks, including long-distance and international networks, telex, a packet switching informational network and electronic mail by broadly integrating modern digital transmission and switching systems. Another goal is to meet the rapidly growing needs of the population and government agencies, and to provide the newly forming market economic structures with modern communications services.

The program calls for all urban families to have telephones by the year 2005, and 50% of rural families. Within a very short time (5-7 years), the construction of modern long-distance and international communications networks and data transmission networks and the creation of honeycomb mobile communications are planned. In order to implement the program, an enormous amount of work must be done. It is unthinkable that this work can be carried out without focusing the efforts of scientific, industrial, construction and service communications enterprises, without using modern equipment and technologies, and without additional investments, including foreign capital.

Historically, the Ukraine found itself in a position in which it did not develop or manufacture digital switching and transmission systems, nor much other telecommunications equipment.

As a result of conversion, more than 100 enterprises of the military-industrial complex have been converted to the production of communications equipment in the past two to three years. They were able to arrange the manufacture of small-capacity quasi- electronic and electronic automatic telephone stations, digital transmission systems for local networks, and some other equipment. As far as large-capacity digital transmission and switching systems are concerned, it would require five to seven years and large financial expenditures to develop them, which is hardly justified given the existing situation. In this area we cannot manage without foreign investments and assistance. This will allow us to buy a significant amount of time.

Unfortunately, the acquisition of modern communications equipment overseas is complicated by the fact that the Ukrainian national currency is not convertible at the present time. It is impossible to buy this equipment at an exchange rate of one U.S. dollar for every 2,000-3,000 coupons, which has been established by some commercial banks. If you consider that the average wage in the Ukraine at such an exchange rate is only ten dollars, the acquisition of equipment overseas makes communications services prohibitive for the Ukrainian population.

With this in mind, we concluded that it was necessary to create joint enterprises for the production of modern equipment in the Ukraine. The equipment produced by the joint venture will be sold on the internal market with partial payment in convertible currency and the national currency. Component parts produced in the Ukraine will be used. The creation of centers for the generation of software and editions of the software will allow the hard currency portion of the cost of these items to be significantly reduced. This alternative allows the need for hard currency to be significantly reduced for equipment payments. This also allows the Ukraine to significantly reduce its production by taking into account a share of the cheaper labor used for the production of equipment in the Ukraine. Of course, according to all economic laws, the manufacture of large lots of equipment causes a reduction in prices, and it will be more expensive to produce small lots of equipment in the Ukraine. However, the inconvertibility of the currency and the high exchange rate of dollars to Ukrainian coupons make the proposals of local industrial enterprises more attractive.

However, for joint enterprises to acquire equipment, a certain amount of funds must be in hard currency. The banks (The World Bank and the European Bank), from which we had counted on receiving credits, drag out the provision of these credits and establish many conditions which cannot possible be carried out in one year. Time is flying. The lack of a market infrastructure, including poorly developed communications, prohibits a market economy from developing normally.

That is why the Communication Ministry's Concept for Attracting Foreign Investments Necessary for the Implementation of the National Communications Development Program calls for the creation of joint enterprises (operating companies) to develop and provide communications services, in addition to the creation of joint enterprises with Western firms to produce modern communications equipment. This allows results to be seen

much more quickly, and development with bank credits to take place during phase two.

Based on this concept, the MKM Telekom joint venture for producing EWSD equipment has already been created (the Koroleva Production Association and Siemens in the FRG), as well as the ChRPZ and AT&T joint venture in Chernigov for producing 5 ESS equipment.

Preparations are being made at the Odessa Cable Factory to jointly produce fiber-optic cables with the U.S. AT&T firm.

While the production of equipment was being organized, specialists from the Communications Ministry were actively searching for Western partners for joint implementation of Ukrainian telecommunications development projects. As a result of this search, three joint operating enterprises were created:

- UTEL, a Ukrainian-American-Dutch-German enterprise, founded by the regional communications administrations of the Ukraine together with AT&T, PTT Telecom, and DBP Telecom. By the year 2005, the joint enterprise should modernize and develop 25 regional automatic international telephone stations and participate in the construction of six million local lines.
- UMT, a Ukrainian-Dutch-Danish-German enterprise, founded by the regional communications administrations of the Ukraine together with PTT Telecom, Denish PPT, and DBP Telecom. The joint enterprise should create a honeycomb telephone communications network in 21 cities of the Ukraine within seven years.
- INFOKOM, a Ukrainian-German enterprise, founded by the "Kievsvyaz" Production Association and an informational computer center together with Controlwere, a German firm. The joint enterprise should have already created "UKRPAK," a national packet switching center, in 1993.

Since the newly created joint enterprises, as well as the highly profitable ones, will provide a significant portion of low paying services (the majority for the national currency), and since one of the main sources of currency receipts necessary for developing and repaying the currency investments of Western partners is international communications services, these joint enterprises have received the exclusive right to provide such services.

This right is also provided to them because free competition does not always justify itself when communications services are thinly spread, and it can cause higher quality services to be provided in the economically developed regions and fully satisfy demand, while low-paying services may not be provided at all in regions with a poorly developed economy, which can destroy the harmonious development of the whole infrastructure of the state.

The newly created joint enterprises have already begun to implement specific projects. On 17 November an international telephone station system in the city of Kiev went operational. On 17 February 1993 a new automatic international telephone station came on line in Lvov. In 1992 the first 20 subscribers began to operate on a packet switching network.

By using joint ventures and by taking advantage of bartering, the investment of approximately 100 million U.S. dollars in the development of communications in the Ukraine is planned in 1993. Automatic international telephone stations will be modernized in six regions, and a telephone communications network will be brought on line in Kiev. All the areas and regions will receive access to the packet switching network.

Despite the economic decline which continued in 1992 in the Ukraine, the communications industry had 30% more revenues than in 1991. The decline in the rate of development of international telephone stations was stopped.

Of course, everything cannot be resolved so simply. There are many problems. Sometimes partners do not understand each other. However, if the desire is great on both sides, any problems which occur can be resolved. Unfortunately, some want to get a quick return and do not want to work toward the future.

We need to modernize the primary network with fiber-optic communications cables, and we hope to carry out this work by obtaining credits. It is clear that credits can be obtained if the investors are completely convinced of a return on their investment. Therefore, we are working on improving the structure and changing the tariff policy. We are learning to earn money. Values are being reassessed. This reassessment is not always understood by our people, who are used to having social guarantees. However, there is no other way.

Ukrainian legislation is creating favorable conditions for foreign investment. In accordance with the law "On Foreign Investments," these investments are not subject to nationalization. Reimbursement of losses is provided for, if governmental organizations act improperly, and the transfer of revenues and profits after payment of taxes and mandatory duties is guaranteed. The law gives enterprises with foreign investments the right to determine prices for their products. The joint enterprises are not taxed for five years, and then a tax is established at 50% less than the existing tax. A portion of the profits which are reinvested in the Ukraine will not be taxed.

The creation of joint enterprises and the integration of elements of market relations have revealed inadequacies in the industry's management structure, and at the present time it is being reorganized. The Communications Ministry will not fulfill the function of operating company any longer, nor interfere in the economic and financial activities of the enterprises, but will determine and be responsible for the political and strategic aspects of development, and will accept responsibility for regulating and creating conditions for competition in the industry.

Work is being carried out to create a major association on the republic level. This association will be involved in a unified process in telecommunications and will eventually turn into a holding company.

Foreign investment, advanced technologies and the operating experience of Western partners under market conditions will shortly permit a qualitative breakthrough in the telecommunications field in the Ukraine. These will also permit the integration of telecommunications into the world-wide network, which will create good conditions for establishing market organizations in the economy and for widely attracting foreign investments to develop the economy in other industries as well. In the final analysis, this will accelerate the process of bringing the Ukraine closer to the advanced countries in the telecommunications field.

Russian Communications Minister Discusses Telecommunications Policy

947K0037A Moscow VESTNIK SVYAZI in Russian No. 6, Jun 93 pp 8-10

[Article by V. B. Bulgak]

[Text]In Russia, the current level of telecommunications development corresponds overall to the state of the Russian economy. Quantitative indicators for the industry rise steadily, although the rate of their growth has somewhat slowed down recently.

However, there is no cause for complacency. The industry does not permit market structures to function with certitude. Quality is not high, and the volume of the industry's main services is limited. The most modern types of these services are poorly developed.

New requirements for communications services and the gradual formulation of a market economy made it necessary to develop a new state policy in the industry.

Recently, the Russian government adopted "A Concept for a Russian Federation Program in the Communications Field." This concept determines strategic approaches for the industry to move ahead in the forthcoming period, including stages and ways to move ahead.

On the basis of this document, specific programs for individual types of telecommunications are being developed, including regional programs and programs for specific sub-branches of the industry. These programs provide for:

- Prioritizing the development of the communications industry and establishing an incentive-based state policy in this area;
- Optimally combining state investments in the industry with the combined resources of enterprises, as well as drawing on private domestic and foreign capital;
- Using all forms of private property in the industry, and eliminating monopolies which provide communications services;
- Creating the legal means for developing communications in the country, as well as legal guarantees drawing domestic and foreign enterprises into investments;
- Converting the communications field, including the conversion of the radio frequency spectrum;
- Establishing a new tariff policy for communications services;
- Licensing by the state for the activities of individuals and organizations in the field of communications and certifying communications equipment and services;
- Creating new types of communications services;
- Integrating domestic communications networks with foreign ones;
- Gradually eliminating disproportions in the development of communications region-by-region, by taking into account the state of their economies.
- Restructuring the industry.

In order to implement the "Concept for a Russian Federation Program in the Communications Field," a regulated telecommunications market must be created.

The regulating role of the state involves concentrating efforts on key trends for developing the industry, creating conditions for satisfying the needs for communications services, conducting a coordinated technical policy, coordinating communications networks, and creating a civilized community of communications operating companies in the country.

The incentive-based state policy for developing communications calls for a preferential taxation and credit system. These preferential terms should be implemented when dividing land parcels for enterprises and communications facilities, when renting spaces, when local authorities allot subsidies, and when reducing taxes being charged to communication industries. The funds which are received should be used to invest in the communications industry.

The investment policy should be designed to attract foreign capital from all over the world, and this policy should primarily be implemented on the basis of the individual and combined resources of enterprises, associations, banking and other organizations, and individuals. Appropriations from the state budget are intended for use to implement the largest state programs.

Creating the legal basis so that the industry can function calls for the adoption of legislative acts of the Supreme Soviet, decrees of the President, and mandates of the government. These will ensure conditions for the development of communications in the country and provide

legal guarantees for the functioning of the industry, including the protection of subscriber's rights, property protection, licensing and certification.

All the interrelated communications networks of Russia are public networks, department networks, and private networks. They form the Interrelated Communications Network of Russia, and they are created and developed using the principles of organizational and technical unity and mutual redundancy. The Russian Communications Administration particularly focuses on regulating the technical and organizational aspects involved in interrelating the various communications networks.

Enterprises in the industry are created on the basis of the similarities and differences in forms of property under competition. Networks and communications equipment may be state property (federal property, the property of subjects of the federation, or municipal property), or it may be the property of individuals or organizations, including foreign ones.

In order to improve the management of the communications industry in the new economic conditions, the industry is being restructured. Three independent subgroups in the industry are being identified: telecommunications, television and radio, and postal. At telecommunications enterprises the stock auctioning process has already begun. The creation of non-state companies is also being supported, including those involving foreign capital.

The new tariff policy in the communications field is characterized by its liberalization, and as the economic situation in the country stabilizes and market forces are adopted in the industry, it will also be characterized by a gradual reduction in interference on the part of the state in setting tariffs for communications services. Elements of state regulating are intended to retain social access to the main communications services while economic restructuring takes place in Russia.

Destroying the monopoly on providing communications services calls for the provision of these services by several operating companies. A license issued by the Russian Communications Ministry gives the right to provide communications services, and this ministry controls the quality of the services. Some services call for a competition to issue the license, which also serves the interests of the consumer, and serves to create an effective telecommunications system in the country.

In order to ensure high quality in the services being provided, and to preserve the compatibility of the communications networks and equipment, existing and future networks should be guarded against the appearance of equipment which does not meet the standards established for Russia in these networks. Therefore, each type of equipment to be installed must have a certificate issued by the Russian Communications Ministry on the basis of the results of testing conducted in specially created certification centers.

New types of communications services which are being created by competition, primarily for fulfilling the needs of market economy organizations, include the following:

- high quality digital communications networks;
- data transmission networks with packet switching;
- high quality facsimile systems based on digital networks and/or modern data transmission networks;
- systems for receiving information from data banks;
- message processing systems, which permit telecommunications text retrieval services to be united into one automated system for message traffic between subscribers;
- mobile communications systems for document and speech traffic.

Calculations show that solvent demand for similar communications services is fairly high. For example, the demand for digital telephone communications services is approximately 3.0- 3.5 million telephone sets, and for telecoded communications services (data transmission, message processing, and high quality facsimile communications) it exceeds several thousand connection points. At the same time, the potential exists for quickly fulfilling this demand by creating commercial organizations.

An important aspect of the Russian state policy in the communications field is international cooperation, which should become one of the ways for this industry to get out of this difficult position under modern con i-tions. This cooperation is developing in the following areas:

- Attracting foreign investments to carry out national and regional programs;
- Creating joint enterprises to introduce advanced technology and new equipment into Russian communications networks;
- Expanding existing international communications networks, and increasing the volume and quality of services provided to subscribers of the public networks in order to more fully integrate the national communications system with communications systems of the world community;
- Carrying out major technical projects with foreign firms;
- Purchasing imported equipment for the Russian communications network;
- Initiating scientific and technical exchanges, and attracting foreign specialists to provide an expert's analysis of national programs and projects;
- Participating in the work of the International Telecommunications Union;

Adapting the communications industry to new economic conditions and new subscribers' demands will require a certain amount of time and can be carried out in stages. During stage one, the critical situations in the industry have to be stopped with extreme measures, since the crisis in the country's economy is continuing. This stage began in 1992 and also encompasses the current year of 1993.

The main measures to be carried out during stage one are the following:

- Liberalizing the tariff policy in the industry in order to increase enterprises' revenues, primarily by providing new and higher quality services to commercial market organizations. During this stage, elements of state tariff regulation will be maintained for the population and organizations funded by the state;
- Improving the industry's management structure, which was already discussed, and privatizing enterprises;
- Carrying out projects which will be implemented in relatively short time periods and will receive moderate capital investments will allow a fast return to be obtained. By the same token, this will make it possible to obtain the means for developing subsectors of the telecommunications industry with low profits. Such projects primarily include the creation of an international communications system in Russia, and the development of systems which will allow new, highly profitable services to be provided (for example, honeycomb radiotelephone service or data transmission with packet switching);
- Introducing new mechanisms for payments between communications enterprises. This will ensure the proportional distribution of revenues received by the industry among the participants in the information transmission process. This will give all enterprises the chance to develop by using their own resources;
- Increasing the performance of existing communications equipment and networks.

The second stage calls for a set of measures for supporting the functioning of the industry at the level which has been achieved, for stabilizing the economic situation in the industry and for preparing it for accelerated development. In terms of time, this stage corresponds with the transitional period associated with overcoming the crises in the Russian economy (approximately 1994-1995).

During this stage, the structural changes previously begun in the industry will be completed, issues of improving standards will completely be resolved, conditions will be created to broadly attract domestic and foreign investments into the industry, the integration of modern communications equipment and the development of new types of services will continue, market mechanisms will be improved, and eliminating the monopoly in the industry will continue.

Stage three (probably in 1996-2010) calls for measures to accelerate development of the industry after the crisis is overcome, and the evolution in the country's economy progresses. This stage presupposes significant investment growth in communications, a qualitative jump in converting networks with modern technologies for the transmission and processing of information, and increased integration of the telecommunications networks of Russia into communications systems of the world community.

It will be possible to increase the capacity of the public telephone network to 63-78 million basic telephone sets, and raise telephone density to 40-50 units per 100 inhabitants. New country- wide networks will arise. They will provide modern services which will be available to a broad range of subscribers, as well as high quality and expensive services for a more narrow group of subscribers. A general national data transmission network will appear, as well as a Russian intelligent network, and a digital network with integration of services. This will permit the creation of a telecommunications organization that will fill the demands of developing market relations.

As far as prospects for foreign partners participating in developing communications in Russia is concerned, this is already being carried out in many areas.

Our relationship is developing with communications operating companies, investment firms and international banks, with whom we are implementing major projects, both international and national in scope. An example of such successful cooperation is the construction of Russia's first international underwater fiber-optic line from Russia to Denmark in a system with digital radio relay links and three international switching stations.

One of the first examples of cooperation with foreign operating companies inside the country in the field of public networks is the project to create a modern communications network in the Kaliningrad region. A branch of the France Telecom Company is taking part in the project. The joint enterprise organized by this firm and its Russian partners already has a license for the creation of a dedicated line, and a permit to build a network integrated with the general telephone network is now being processed. Foreign partners are participating heavily in the creation of modern data transmission networks in Russia. Many networks with packet switching which are successfully functioning and dynamically developing have a foreign operating company partner, for example, the SPRINT network, INFOTEL, POCHET, and others.

Another important trend in developing cooperation is for domestic factories, primarily those which have been converted, to organize joint enterprises with foreign firms which manufacture communications equipment. Among them are firms such as IZHTEL, which are

expanding into the production of modern switching equipment, which is extremely necessary now in Russia. Moreover, since there are limited currency resources, we prefer this form of cooperation to direct acquisition of communications equipment overseas.

An important mechanism for the state to regulate the industry market is licensing. Licenses for the right to provide many of the most economically attractive services are being competed. In this way, there is a selection of the most fully developed proposals which are the most effective and convenient for subscribers, and which provide effective use of limited resources, like the radio-frequency spectrum, the resources of satellite communications systems and telephone numbering.

Consequently, licenses are issued on a competitive basis for communications networks which have independent access overseas, and for honeycomb communications networks with NMT-450N and GSM-900 federal standards.

The first such competition for the GSM-standard networks has already taken place for 12 areas, regions and republics in the Russian Federation. US West, our partner of long standing, has won this competition with its Russian partners in 8 regions.

In order to issue a license to organize regional honeycomb systems for which the 800 MHz range has been identified, support of the regional administrations is necessary.

The state is interested in developing networks which provide local and long-distance in-country telephone service. However, these networks require larger capital investments than small networks having international access, and they are less profitable. Therefore, in order to provide incentives to operating companies working within the country, more favorable conditions for connecting with the public networks have been established for them.

If private international communications networks must interact with the country-wide network at the international switching center level, then local and long-distance operating companies can be connected to local and long-distance public networks.

Russia is a colossal market in the communications area both for operating companies and for equipment manufacturers, and Russia is trying to enter the global telecommunications society as a worthy member, having not only the most extensive communications network, but striving to build this network on a modern technical level.

We invite all our partners from the countries taking the place of the former Soviet Union and from neighboring countries to cooperate with us as equal partners in a mutually profitable manner.

Defense Conversion Projects in the Telecommunications Sector Described

947K0037C Moscow VESTNIK SVYAZI in Russian No. 6, Jun 93 pp 19- 22

[Article by P. Chachin]

[Text]The conversion of defense enterprises to the manufacture of civilian products has already been occurring for several years. Nonetheless, the state conversion program has not yet been developed, and discussions on ways to implement it continue. While ways to solve the problem are being discussed, conversion continues. Many major, well-known defense enterprises which are part of the Aviation Industry Department, Radio Industry Department and Communications Industry Department of the Russian Industry Ministry (now the Russian Federation State Committee on Defense Industries), are beginning to fill civilian orders. Their activities in the telecommunications field can be attested to by the exhibits shown at the end of last year in Moscow at the "Conversion-92" International Fair Showroom, the "Science, Business, and Industry to Agriculture" displays, and the "Communications-93" International Exposition organized in May of this year. Materials from these exhibitions were used to prepare the article published below.

In the Russian Federation, where 69% of enterprises and organizations of the former U.S.S.R.'s military industrial complex are concentrated, conversion encompasses a wide circle of industrial enterprises, research institutes, and construction, operating and other organizations. In order to use their potential in the interests of developing a civilian communications network, the following main conversion trends have been provided for:

- redirecting the industrial, scientific and technical potential to produce and develop communications equipment for civilian purposes;
- using military communications equipment that has already been created and is already in production by making the necessary modifications for the economy;
- using scientific and technical achievements obtained during the development of military devices in order to create modern civilian communications equipment.

The main trend in the work to convert enterprises from military to civilian production is the creation of telecommunications systems and equipment within the framework of the Russian Federal Target-Oriented Program for Developing Communications Equipment and Information Systems in 1992-1995. The components of these programs (conversion programs for individual enterprises and scientific research institutes) have undergone an expert's analysis in the Communications Industry Department and Ministry of the Economy of the Russian Federation, the Ministry of Finance and Russian Central Bank.

Military communications equipment is being more widely used in the civilian industries of the economy. Though operators on geologic expeditions, on gas and oil pipelines, in energy networks and so on previously thought it was an impossible dream to acquire this military equipment, now many former limitations have been removed.

A significant percentage of special radio communications and radio relay communications equipment commercially-produced by enterprises of the military industrial complex can be used without any kind of significant modifications or modernization in various spheres of the economy, especially in the agro-industrial complex, where advantages of military equipment such as operation in broad temperature ranges, dust and moisture resistance and anti-shock qualities of the equipment, independent electrical powering, easy maintenance, etc., may be required to the greatest degree.

These types of devices are small ones (hand-held and driven) for dispatcher communications, stationary radio communications devices, radio relay and tropospheric communication devices for arranging interregional, regional and technical communications. In total, specialists of the "Telecom" joint-stock company have calculated that about 40 types of communications devices can be supplied to consumers in the economy without any type of alterations.

Some types of these devices are made by the Popov Factory AN Production Association (Nizhni Novgorod). Among them are R-980 "Canoe" mobile control centers, R-849M1 mobile communications radio unit, and the R-986 communications unit.

Among the purely civilian communications equipment, the "Iset" digital radio relay system must be mentioned. It was developed by the "Vektor" State Enterprise (Yekaterinburg) and operates in the 15 GHz range of telephone channels (with a digital information transmission speed of 8.448 Mbit/sec) between urban and rural automatic telephone stations and telephone stations of individual industrial and commercial facilities. The digital information transmission distance is no less than 30 kilometers for one transit of the radio line. The stationary equipment of the "Iset" radio relay station connects with standard devices of IKM-120, IKM-30 and IKM-15 digital transmission systems, which markedly simplifies its usage in local communications networks.

The "Polet" Scientific Research Institute (Nizhni Novgorod) is one of the largest producers of aviation radio communications equipment in the country. It is offering portable radio stations, automobile data transmission terminals, etc., to the economy.

The "Moscow Scientific Research Television Institute" Joint- Stock Company creates low-power television retranslators and transmitters, cable television systems, television monitoring receivers, and a specialized computer for colored television studios.

The low-power television retranslator is designed to provide television broadcasting to small towns blocked by the local relief from the direct signal of a powerful television transmitter.

A small-power television transmitter generates and radiates standard high frequency television display and sound signals on any given channel in meter and decimeter wave ranges. It can also be used to provide television broadcasting to small towns located along radio relay line routes, to create local broadcasting television centers in small towns, collective farms, and state farms, and to organize training television centers, etc.

The commercial system of cable television is designed to distribute television programs to subscribers along fiber-optic communications lines via subscriber switches located remotely from the program distribution point. This allows the transmission of one of eight television programs with sound to the subscribers' receivers at their selection. The number of subscriber switches is not limited in this system.

Backward channel equipment for cable television systems permits data to be exchanged between the head station and distribution network devices, as well as subscriber devices, in order to broaden the number of services provided to the subscriber, and in order to make it possible to supervise the status of the distribution network and the line, distribution and house amplifiers, as well as other engineering facilities located in homes serviced by that cab television system.

By using this promising equipment, subscribers can obtain additional services, such as fire and intrusion detection for rooms, medical assistance, and pay-per-view for commercial television programs.

The KTV-1 specialized computer is designed for colored television studios, mobile television stations, training television centers and video libraries. It generates a TV signal of text and graphic information simultaneously with the control room signal and allows work to be carried out in the mixing, special effects and rear projection modes. The KTV-1 can use a variety of text and graphic editors and programming languages. The use of this device allows the technical and creative potential of television studios to be broadened.

The "ASTRA" Scientific Production Association has developed a stationary transmitter-receiver control room called "Liliya-S," which is designed to be placed at terminals of reporting radio relay junction lines of the "Liliya" and "Liliya-1" type, and to service television channels and the sound accompaniment channels of reporting radio relay lines. It is possible to place from one to six reporting radio relay line terminal units in the control room. Depending upon how it is equipped, the stationary transmitter- receiver control room services from one to three duplex communications channels. The

control room corrects, controls and switches video signals and sound accompaniment signals, remotely controls the antennas, loud speaker and telephone communications, and dispatcher radio communications.

The "Vektor" state enterprise manufacturers TMS-1517 and TMS- 1517V international and long-distance pay phones. Payment for conversations is made with coins, tokens, or by credit card. There is precise control of the tokens, money and credit cards; slugs are weeded out; the deposited tokens are counted; the number being dialed and the connection time remaining after the next coin or token has been collected are optically displayed; the sum remaining can be used to pay for making a connection with another subscriber with the appropriate recalculation of the tariff; conversations are automatically tariffed; and pay phones are monitored from the automatic control panel.

The Lavochkin Scientific Production Association, the Academician A. A. Raspletin Scientific Production Association of the Russian Federation, the "Radio" Scientific Production Association, MRTZ (Moscow) and a number of other organizations are developing the "Nord" commercial satellite communications system. This system is designed for the northern regions of Russia, in particular the Tyumen region. The system will include a full set of space and ground equipment created under a unified project. This will allow qualitatively new services to be provided to stationary (fixed) and mobile subscribers, and will ensure the system functions no matter what state the traditional domestic communications equipment is in. It will be possible for users to have direct access to the satellite via their individual stations, which will make two-way subscriber communications possible almost throughout all of Russia and the foreign countries, bypassing the existing communications network. Individual fixed communications stations can be interfaced with the local telephone network. An operating mode and signals which correspond to international standards have been provided for. The stations will provide telephone, telefax and telex communications, and intercomputer data exchange according to international protocol. Portable stations with 1.5-2 meter antennas will be developed. The frequency range is 11-14 GHz.

Satellites of the "Nord" system will be launched from the territory of Russia into a high elliptical orbit with a 12 hour orbital period. The highest point of the orbit (40,000 kilometers) is located in the northern hemisphere at 63 degrees latitude. Within a 24 hour period, the satellite will rise above the northern hemisphere two times. The length of the communications session last 6.5 hours on each loop. Thus, one satellite provides communicates for practically all regions of the northern hemisphere in a 24 hour period, as well as a portion of the southern hemisphere for two time intervals lasting 6.5 hours each. The total time is 13 hours. If two satellites are functioning, 24 hour communications is provided.

" Nord" plans to use three or four satellites in the system for redundancy. The use of satellites in elliptical orbits for timely communications in the northern hemisphere is advisable for several reasons. First, all northern hemisphere countries which are inaccessible to traditional communications satellites located in geostationary orbits fall within the line of sight of each satellite. Second, effective communications at high latitudes are possible. Third, launching a satellite into an elliptic orbit requires significantly less expenditures and can be carried out in a compressed time schedule (the advantages in launch time and cost of the carrier rocket are a factor of five to six), and the cost of providing the services can be two or more times less that the existing level of both world and internal Russian prices. This year there are plans to assemble and perform surface testing of two satellites.

The Makeyev Design Bureau (Miass) is developing a personal satellite communications system. In order to implement this system, the "URALKOSMOS" Joint Stock Company has been formed. It has been directed to attract support for the project from commercial structures.

The personal satellite communications system is similar to the "Iridium" system of the American Motorola Firm. Since it has its own carrier rockets which can launch satellites into low orbits (approximately 700 km), the specialists of the design bureau have decided to independently develop a domestic system. V. Kalashnikov, the leading specialist of the marketing service of the Academician Makeyev "Space-Rocket System" Machine Building Design Bureau feels that, "...there is no problem in connecting these two systems."

The cooperative of development engineers includes about 100 enterprises and organizations. The number of communications satellites in the orbital group will be 32-48. The frequency range will be 1.5-1.6 GHz. The information transmission speed will be 32 kbit/second.

The creation of several types of terminal equipment has been proposed, from stationary systems, which include a computer, telex, printer, and fax, to simple portable stations weighing from one to two kilograms. The latter can be of wide use in expeditions, geological teams, for servicing gas and oil pipelines, electrical networks, in special services, etc.

The Radio Device Construction Scientific Research Institute (Moscow) is developing the "Signal" mobile satellite communications system. The "Energiya" Scientific Production Association and the "Polet" Production Association are among those carrying out the project. It is a commercial system based on low orbiting satellites. It contains a central amplifier station, a flight control center, a space segment composed of 48 artificial earth satellites, a base station network consisting of 5 stations, and subscriber stations. The number of orbits is 4, the inclination is 72 degrees, the elevation is 1,500 kilometers, and the satellite's orbital period is 116 minutes. As a launcher, the "Tsiklon" carrier rocket will be used. A

launch is planned in 1993, and deployment into the national system in 1995. Deployment into the global system is planned for 1997-2000.

Based on the space communications devices launched into operational orbits by the "Energiya" carrier rocket, the "Globus" space communications system is being developed.

Space devices for the system are being created on the basis of achievements made by the "Energiya" Scientific Production Association and on the basis of cooperation in the area of complex space systems, including the "Energiya-Buran" shuttle transport system and piloted orbital systems.

A spacecraft's potential to position heavy payloads with large power-to-weight ratios of unified space platforms allows retranslators to be furnished on one craft. These retranslators simultaneously carry out several functions (fixed and mobile communications, and direct television broadcasting). This potential also allows the productivity of the satellites to be sharply increased, and the number required in orbit to be sharply decreased. Moreover, it simplifies and reduces the cost of receivers.

The Moscow-based Radio Communications Scientific Research Institute is creating the "Oreol" on-board retranslator, the "Kanat-1S" on-board antenna system, the "Potok-P1" and "Potok-P2" small satellite communications stations, the "Format-P" device, the "Shtrikh-P" channel receiver and a demonstration program for processing satellite information. These are being created for a domestic space system for observing the Earth's surface. This system is based on the "Planeta-S" geostationary satellites and is similar to the Meteosat European system now being operated at the present time, the American GOES, the Japanese GMS and the Indian "Insat."

The "Potok-P2" small satellite communications station (radio buoy) is designed to receive and transmit formalized messages from meteorological data collection platforms. The "Potok-P1" station only receives messages. Both stations can operate on vehicles, on geological expeditions and in other areas. They meet the requirements of the international information collection system.

The on-board "Oreal" retranslator collects and transmits data from data collection platforms and from ice exploration aircraft on the hydrometeorological and heliogeophysical situation on the Earth's surface and in the world's oceans. It transmits televised information on cloud, ice and snow cover on the Earth. Its functions also include the transmission of data on the radiation and magnetic situation in near-Earth space, and the distribution of weather maps and other processed meteorological information to users.

With the launch of the domestic artificial Earth satellite for operating in the global operational meteorological satellite system, the country has obtained a large flow of meteorological and geophysical information for use in the economy.

The Avtomatiki Scientific Industrial Association (Yekaterinburg) has developed the IGLON inertial satellite system. The system is designed for navigation of spacecraft, aircraft, sea and lake craft, and automobiles, as well as for determining coordinates when resolving mapping, geodesic and geophysical tasks.

The system includes a small inertial gyrostabilized platform and a multichannel receiver for radio navigation signals of the GLONASS and NAVSTAR satellite systems.

Depending on consumer requirements, it is thought that various models of the IGLON device will be manufactured. Each has different characteristics and design.

Among the other interesting developments in communications, there are the "MAG" subscriber station (President's Federal Agency of Governmental Communications and Information of the Russian Federation), the packet communications controller (COMPAS-R., Ltd. packet communications company), the multifunctional antenna system ("Fayvish Sheyner and Co., Ltd." joint stock company in Nizhni Novgorod and the Pravdin Factory of Radio Relay Equipment), the "STELA-64" automatic electronic telephone station (SVT Scientific Production Association in the city of Kirov), the KST-300 telephone scrambler (coding device on a digital channel) and the KST-101 device for closed communications ("KOMREK" joint stock company in Moscow).

The "KOSMOS" Joint Stock Company (in Krasnoyarsk) has developed the "Kosmos-S" satellite communications system, which is designed to: (1) organize communications in inaccessible regions; (2) create organizations which make it possible for banks, stock exchanges, trade houses and other producers of goods and services to begin using the newest electronic operating technologies; (3) create commercial informational data bases on various fields for Russian and foreign users; and (4) to open international computer networks to Russian users.

The "Kosmos-S" satellite communications system is based on the usage of stationary artificial Earth satellites of the "Gorizont," "Raduga," and "Express" type, and it consists of a network of "Kosmos-SA" ground subscriber stations which operate under the command of a "Kosmos-STs" ground central station. In 1993, 60 subscriber stations were deployed in Russian territory and neighboring countries. In future, their number will be increased to 1,000-1,500.

The DALS firm (St. Petersburg) is one of Russia's leading developers and manufacturers of telecommunications systems and equipment for various purposes. Using the potential that was released under conversion, this firm has created a number of new products.

The mobile radio fire and intrusion detection warning system developed by the firm is a wireless system for fire and intrusion detection for various industrial, cultural, and agricultural facilities. It is significant in that the devices can be deployed, dismantled and set up again in a new location quickly. It has various configurations, depending on the specific requirements for facility protection, and it operates without regard for the serviceability of the facility's main electrical power network.

There is one other product of the firm—the SA-1 hearing aid for individuals with weakened hearing. It is made in a small, over-the-ear case, and is held in place on the outer ear with a sound wire that ends with an ear insert. The device is equipped with a volume control, and a switch for conversation modes where the speaker is present or is speaking on the telephone, and a power switch.

The "TEKOS, LTD.," Company (Moscow), which was created in 1992 on the basis of the Central Machine Building Scientific Research Institute which studies space research, has developed a telecommunications and message processing system. The system uses effective, fairly inexpensive domestic technology which combines a personal computer with a packet switching network based on the MKKTT X.25 and X.32 recommendations. The system insures the confidentiality and safety of information being transmitted and processed by using special, certified software and hardware. At the present time, TEKOS is widely used in banking (clearing house) organizations for transmitting information.

The RAZAN Radio Factory offers the R-173-1SV radio station, which provides two-way telephone radio communications that do not require fine-tuning or searching between stationary stations, nor between mobile objects on any of the six pre-established frequencies.

The Nizhegorod "Kvarts" Scientific Research Instrument Building Institute has developed a BM-01 TMS pay phone which is designed for long-distance conversations between cities using a credit card distributed by the communications division.

The pay phone automatically establishes payment for a conversation based on zone and time, independently establishes tariffs for the automatically established connections and makes the appropriate annotation on the credit card. The degree to which the monetary assets of the credit card are used during the conversation is displayed on the digital indicator.

The pay phone is connected to the subscriber lines, which are equipped with a device for automatically determining the number. Access to the long distance telephone network is provided along the record operator's connecting lines.

The "YARZ" Joint Stock Company (in Yaroslavl) with the St. Petersburg subsidiary of the RADIO Scientific Production Association have created "Kompleks-MG" equipment for digital radio relay lines, which provides communications along a narrow radio beam in the 10.7-11.7 GHz range at a distance of 15-45 kilometers.

The series 300 modern equipment system for distribution television networks and cable television has been developed here, in conjunction with the Minsk "Gorizont" Production Association. This system includes a head station, linear, main line and home amplifiers, and television modulators.

Thus, hundreds of enterprises of the defense complex are prepared to find peaceful uses for their resources, and they are ready to cooperate with the communications industry, with new commercial organizations and foreign business partners who need their potential.

Russian Government Telecommunications Strategy Explained

947K0039A Moscow SEGODNYA in Russian 9 Dec 93 p 8

[Article by M. Chernyshov]

[Text]The telephone situation in the homeland is not in need of commentary. More than 60,000 towns that have a population of up to 50 inhabitants do not have telephone service.

The Russian Communications Ministry is attempting to find acceptable options to escape this communications deadlock. In the beginning of December in Yoshkar-Ola, Russian telecommunications workers met with specialists from the Agriculture Ministry to discuss telephone communications problems in the rural areas of Russia.

For the former Communications Ministry of the Soviet Union, state and collective farms were always the main focus of attention. The money that was sent was centralized in these locations, and it was primarily here that systems of internal industrial communications were created. To a certain degree, this helped to provide telephone service to other public facilities in the countryside, such as hospitals, clubs and the post office. Approximately 200,000 new telephone numbers were introduced each year. This number is small, but it has now dropped to 75,000- 80,000 overall.

The Soviet Union Communications Ministry was essentially a gigantic monopoly. The communications industry is one of the largest and most profitable throughout the world. Its yearly volume of products and services is 260 million dollars. Despite the fact that the Communications Ministry brought large revenues to the state, it was treated like a step-daughter. "Now, so-called analogue communications equipment predominates here," Deputy Minister Aleksandr Krupnov attests. These obsolete systems require large industrial rooms and are not reliable or cost-effective. Only 2% of Russian communications equipment meets world standards to one degree or another.

The Russian Communications Ministry now feels that its main function should not be financing, but regulating relations between all organizations involved in this field. The main missions involve issuing certificates and licenses to those commercial organizations which want to work in the communications business. "Today, about 700 enterprises have already received an operating license," Aleksandr Krupnov notes. For now they do not have a very large percentage of the work. Special hopes are placed on foreign capital in the communications industry. It is thought that foreign firms, and far from minor ones at that, will be expressing significant interest in Russia.

Adding to what the deputy minister said, the development of communications equipment was heavily dependent on foreign deliveries, as it turned out in the former U.S.S.R. For example, we received more than 65% of automatic telephone stations and 30% of cable from overseas. Among foreign partners, there were many enterprises from the Comecon countries. Today, preference is given to such leaders as Alcatel, Bell, and Siemens, if the latter propose profitable contracts, of course.

The second strategic line of the Russian Communications Ministry is to have the local municipal administrations agree to all tariffs for communications services. The cost of the services should reimburse operating expenses for the communications systems, pay for credits, and ensure funds accumulate for developing communications networks. This means that no funds will be used from the federal budget for these purposes. On the surface, this approach seems rational, but in practice it is difficult to implement.

In the middle of 1993, the Moscow City Telephone Network established fairly unusual tariffs. For state organizations 80 rubles for each line per month was established. For a private telephone, a little more than 100 rubles was charged, and for all others 1,500 rubles. It is not the numbers themselves that are important here since they change constantly, but their ratios. According to Mr. Krupnov, there is a certain logic at play here. For state locations, the lowest prices are established because there is no point in pumping money in the budget from one pocket to another. Those who have telephones in their homes should receive social protection, and commercial organizations should pay "whole hog," and even more than that, because any prices for them are still just a drop in the bucket.

At one time the Moscow City Telephone Network installed 140,000-150,000 new home and other telephone numbers per year. Today that number is 40,000-50,000. Many districts of the capitol suffer from total "telephone silence," to say nothing of the suburbs, where the population density is incidentally no less than that of Moscow itself. There is much talk about creating a system of fiber-optic communications rings along the capitol boulevards, the Garden Ring road, the circle road and even throughout the Golden Ring. This network will ostensibly provide for more widespread telephone service in the capitol and the region.

"It is not worth becoming too carried away," Mr. Krupnov warns. "Even though fiber-optic cables have enormous capacity compared to traditional cables, in and of themselves they cannot resolve the problem." Installing such lines will make it possible to forget about communications for the next 10-15 years, but all the rest must also be available, in addition to the communications channels. For example, virtually all the telephone numbers in Moscow have been selected. Therefore, new automatic telephone stations must be constructed, and other necessary equipment purchased. Unfortunately, we are in no condition to do this ourselves. The technical level of even our major communications equipment manufacturers does not meet modern standards. The defense industries which are now converting to the manufacture of civilian products also do not instill hope.

Economic reasons remain the stumbling block. Of course, the Communications Ministry feels that it is possible to develop the most modern concept for providing telephone service for both highly populated and sparsely habitable regions of Russia. Foreign investors must be drawn in. In fact this is what is being done. However, without state support it is unlikely that communications will get on its feet.

NUCLEAR AND NON-NUCLEAR ENERGY

Effect of Bending of Reinforcement Elements on a Stressed Atomic Power Plant Jacket

947F0061B Moscow ENERGETICHESKOYE STROITELSTVO in Russian No. 11, 1993 pp 74-75

[Article by A. N. Ulyanov, V. N. Medvedev, A. S. Kiselev, SIBRAE, RNTs [expansions not given] Kurchatov Institute]

[Abstract] Bending of reinforcing cables is found to have a substantial effect on the stressing of the jacket in the driving zone, and this must be considered in the design of this zone. Particular attention must be focused on sections where stretching stresses caused by bending are not compensated. Analysis of the stressing of the driving zone must also consider the effect of all bent reinforcement elements using programs that consider their actual trajectories and friction. Figures 3.

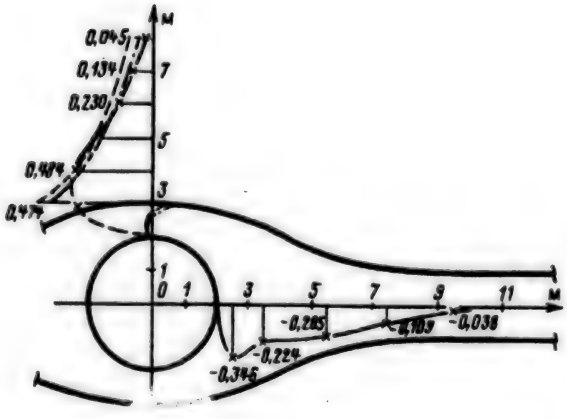


Рис. 1. Эпюр[illegible]ных напряжений в зоне отверстия от воздействия предварительных криволинейных арматурных канатов:

Figure 1. Graph of radial stresses in the aperture zone due to prestressed curvilinear reinforcement cables.

Key: solid line, experimental data; dash line, finite elements calculation; dot-dash line, Melan solution calculation.

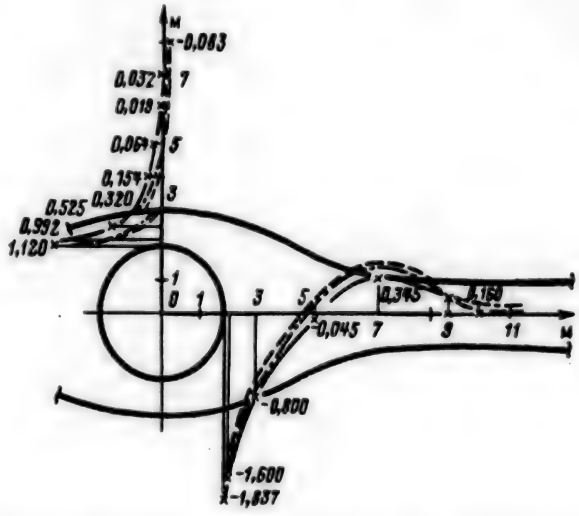


Рис. 2. Эпюры окружных напряжений в зоне отверстия от воздействия предварительных криволинейных арматурных канатов:

Figure 2. Graph of circular stresses in the aperture zone due to prestressed curvilinear reinforcement cables.

Key as in Fig. 1.

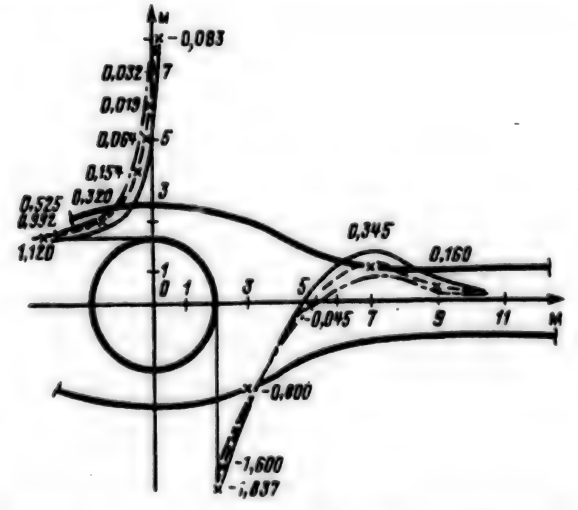


Рис. 3. Эпюры окружных напряжений, полученные с использо[illegible] программы "Аксикон-2":

Figure 3. Graph of circular stresses obtained using the Aksikon-2 program.

Key: solid line, not considering friction; dash line, considering friction, m = 0.1; dot-dash line, the same with m = 0.2.

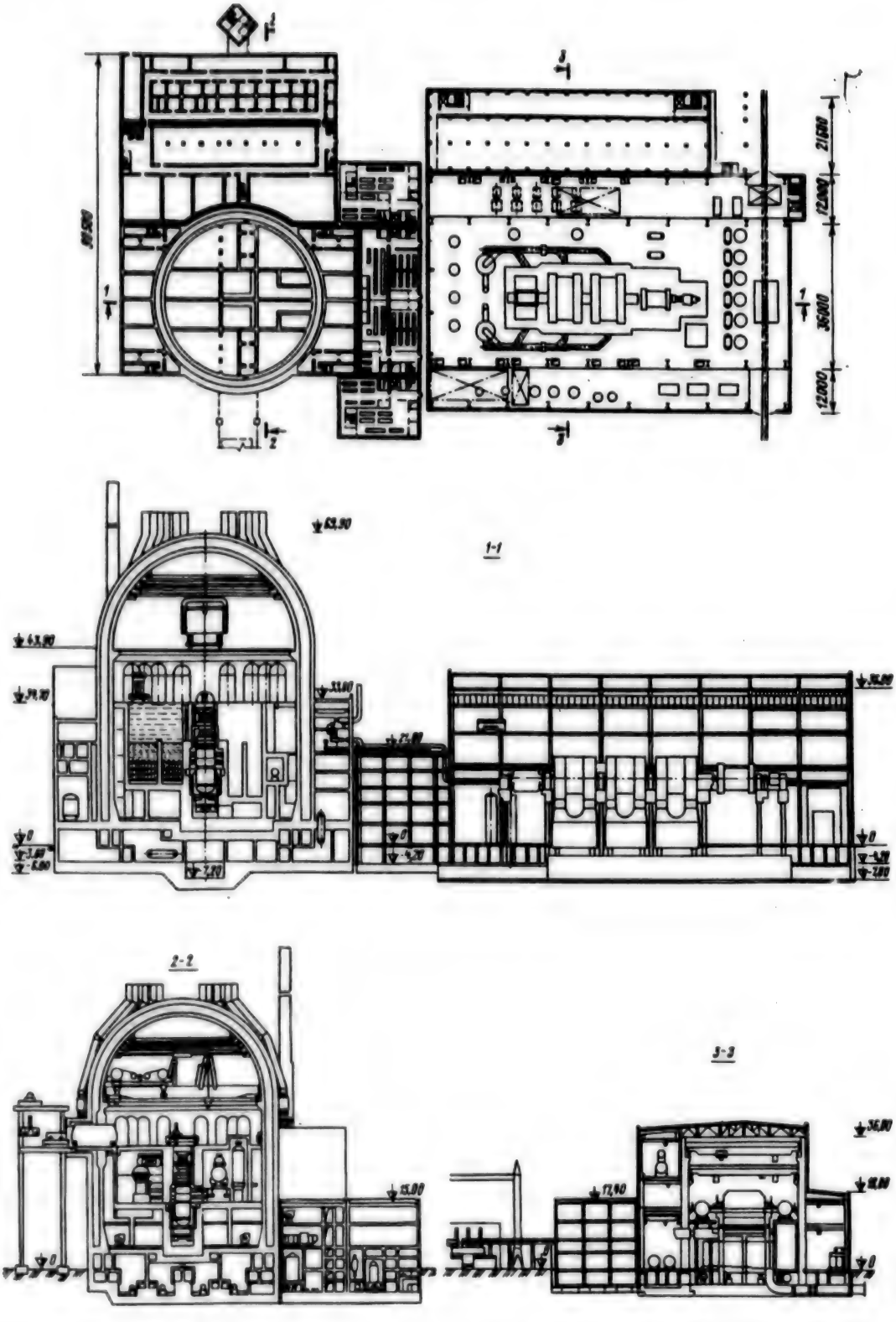
New Generation of Atomic Energy Plant (AES-92)

947F0061A Moscow ENERGETICHESKOYE STROITELSTVO in Russian No. 11, 1993 pp 2-9

[Article by V. I. Kurochkin, M. L. Klonitskiy, B. K. Maltsev, L. L. Bulankova, GNIPKII [expansion not given] Atomic Energy Project, Moscow]

[Abstract] This article describes the measures which need to be taken to improve upon the design of atomic energy plants. Key steps which must be taken are modernization of existing active safety systems, supplementation of traditional active systems with passive systems, and institution of internal self-protection and safety measures. Data shows that the AES-92 design has distinct advantages over the AES U-87 and AES-91 designs. Tables compare the specifications of these designs. In addition to improved safety features, this AES-92 design is more compact and uses less construction materials. The active and passive protection systems used in the AES-92 are described. Radiation safety is discussed. Figure 1; tables 3; references 2 (Russian).

Indicator	AES U-87	AES-91	AES-92
Thermal power of core, kW	3000	3000	3000
Presence of additional safety systems:			
passive fast boron input system	-	-	+
emergency removal of heat through steam generators	-	-	+
recovery system for core meltdown	-	+	+
passive core extinguishing system	-	-	+
passive heat release removal system	-	-	+
Structure of safety system channels			
active part	3x100%	4x100%	4x100%
passive part	individual elements		4x50%
Jacket	Single: prestressed ferroconcrete	Double: external, unstressed ferroconcrete; internal, prestressed ferroconcrete	
Internal diameter of internal/external jacket, m	45	44/50	44/51.5
Steam pressure at outlet of steam generator, MPa	6.27	6.27	6.27
Electric power of turbine at nominal reactor power, MW	1029	1029	1075
Heat used to produce electric energy, kJ/(kW hr)	10,350	10,350	9900
Central heating power of turbine assembly, MW	232	232	500
Cooling medium for generator	Hydrogen and water		water
Electric energy used in system,%	5.8	5.8	5.44
Structural formula of turbine assembly	high-pressure cylinder+3 low-pressure cylinders		
Structural regeneration scheme	4 low-pressure P+D+2 high-pressure P [expansions not given]		4 low-pressure P+D+1 high pressure P [expansions not given]
Number of feed pumps per block, each	2	5	2
Type of feed pump drive	turbo drive	electric drive	turbo drive



Компоновка оборудования главного корпуса
Equipment composition of main vessel.

Russia's Nuclear Facilities Inventoried

947F0066A Moscow SEGODNYA in Russian No. 24, Feb 94 p 9

[Article by Vlad Ignatov and Vera Romanova: "Russia's Nuclear Facilities Inventoried: Absolutely No Order"]

[Text] In the middle of last year, several days after the accident in Tomsk-7, Russia's president issued directive No. 224 instructing the bodies of the Russian Federation's Oversight of Nuclear and Radiation Safety to examine all nuclear facilities and facilities posing a radiation threat to verify that safety and physical shielding measures are being taken at them. By the end of 1993, more than 200 nuclear enterprises and enterprises posing a radiation threat that belong to such departments as the Ministry of Atomic Energy, Russian Federation Committee on the Defense Industry, Ministry of Defense, Ministry of Transportation, and Kurchatovskiy Institute Russian Scientific Center were examined. The Federal Oversight of Nuclear and Radiation Safety focused its attention on nuclear power plants.

The results of the examination confirm that Russia's nuclear power plants are incapable of maintaining their equipment in a safe state or modernizing it. Twenty-nine units at nine nuclear power plants with a total statutory capacity of 21,242 MW are now operating in Russia. This includes 13 units with pressurized water reactors, 15 units with uranium-graphite channel-type reactors, and 1 unit with a fast neutron reactor. Nearly all currently operational power plant units were started up between 1971 and 1990. The only "latecomer" among them is the No. 4 unit at the Balakovo Nuclear Power Plant, which was put into operation in 1993.

From a nuclear and radiation safeguarding standpoint, nuclear power plant units may be divided into two generations. The first-generation units were developed and constructed before the main domestic normative documents regulating safety in atomic energy came to light. Included among them are the Nos. 3 and 4 units of the Novovoronezh Nuclear Power Plant; the first two units at the Kola, Kursk, and Leningrad nuclear power plants; and the No. 4 unit at the nuclear power plant in Bilibino. In the opinion of experts of the Federal Oversight of Nuclear and Radiation Safety, they all require radical reconstruction because their obsolete and physically worn-out equipment and system components are in the habit of failing very frequently. When the second-generation units were developed, consideration was already given to the tolerances that had been introduced at the time. Today, however, the safety rules, and consequently the power plant units themselves, no longer conform to standards.

The Federal Oversight of Nuclear and Radiation Safety has not recently recorded any accidents related to the meltdown of a reactor core or the release of any significant quantities of radioactive materials into the environment. Nor has it recorded any serious fires with the exception of a number of insignificant deflagrations and instances of blanketing with smoke. Incidents involving the operating failure of relief valves and, consequently, nondesign reactor unit shutdown cooling have had the biggest impact on the decrease in the safety of nuclear power plants. The most acute worsening of operating indicators was detected at the Kola Nuclear Power Plant. In the opinion of Federal Oversight of Nuclear and Radiation Safety observers, it is related to a careless attitude toward operating rules and equipment repair. Moreover, a check of the qualifications of about 5,000 technicians at nuclear facilities and facilities posing a radiation threat revealed that nearly 500 of them do not have sufficient knowledge of safety standards and rules. An analysis of violations at nuclear power plants indicates that a significant number, i.e., nearly 40 percent of all violations, have been due to shortcomings in the work of maintenance personnel.

The state of radwaste removal has also become unsatisfactory. An increase in the amount of nuclear fuel stored on site at nuclear power plants and the complete absence of even any desire to remove it at power plants with RBMK, EGP, and MBM reactors have been observed. Another problem arising because of the accumulation of waste at nuclear power plants is that there are no free spaces for emergency dumping of the reactor's entire core. The currently existing system of handling radwaste was developed in the 1960s. For this reason not one Russian nuclear power plant has a complete set of units to prepare liquid and solid waste for burial.

At the initiative of the Federal Oversight of Nuclear and Radiation Safety, the chairmen of its regional bodies took part in an interdepartmental commission to check the nuclear and radiation safety of the nuclear power facilities and equipment of the Russian Federation Navy's northern fleet. Judging by the results of the checks, the state of the overwhelming majority of the northern fleet's facilities and equipment is catastrophic. Personnel often operate the nuclear power plants of warships by the "poke method," with the most flagrant violations of safety rules, and measures to bring them to the required level are left virtually untaken. It is therefore entirely natural that in the past year, seven navy men were hospitalized with a diagnosis of "over-irradiation." Another problem that has evoked serious concern on the part of the Federal Oversight of Nuclear and Radiation Safety is the navy's handling of radwaste. Tanks to store it temporarily are overflowing, and the navy's admiralty is not taking any measures to clean things up. Meanwhile, navy men continue to insist that they do not need outside help.

Economic Efficiency of Low-Power AESs

947F0064a Moscow ATOMNAYA ENERGIYA CCDD94 in Russian Vol. 75, No.5, November 1993 pp 333-336

[Article by F.M. Mitenkov, V.S. Vostokov, V.N. Drozhkin and O.B. Samoylov (OKBM [expansion not given]); received August 9,1992; UDC 621.039.577 182.3.003]

[Abstract] The urgency of developing projects of low capacity AESs for remote regions is stressed. But first one must solve a number of specific problems, such as reducing the cost of power produced at these AESs and providing skilled personnel for operating small AESs in remote regions. The first goal can be achieved by simplifying the design (making it modular), building the modules in a manufacturing plant and assembling them on the AES site. To achieve the second goal the design must permit prolonged AES operation in an automatic mode remotely controlled from a center that serves several such AESs. The article describes technical requirements to and schematic and design solutions of elements of low-power AESs developed at the OKBM. AESs built using these principles will meet requirements of self-sufficiency and there will be no need for permanent on-site presence of the operating personnel. Based on presented information it is contended that low-power AESs can have substantial technical and economic advantages over power sources that use organic fuels. Figures 3, references 2.

Role of Individual Factors in Development of Chernobyl AES Accident

947F0064b Moscow ATOMNAYA ENERGIYA CCDD94 in Russian Vol. 75, No.5, November 1993 pp 336-341

[Article by Ye.O. Adamov, A.Ye. Domoradov, Yu.V. Mironov, Yu.M. Nikitin and Yu.M. Cherkashov (NIKIET [expansion not given]); received uly 15,1993; UDC 621.039.562.3]

[Abstract] Immediately after the Chernobyl AES accident a large number of design and analytical studies of the development of the accident and the role of various factors in that situation were performed at NIKIET and other research centers, including foreign ones. This has made it possible to perform numerical studies of the origin and development of the Chernobyl AES accident. The article presents initial results of such analysis using the Relap 5/mod 2 program; the standard version of this program is widely used abroad in studies of NEPUs [nuclear electric power units] safety. The article examines two problems: 1) studying the effect on the system of operation of emergency protection equipment A3-5 and short-term insertion of positive reactivity into the core when moving emergency protection rods during a pre-accident condition of the reactor, and 2) studying the consequences of turning off the turbogenerator and of run-out operation of two of the four operating main circulation pumps [MCPs] in each loop. Calculations performed for a reactor condition that was close to the condition of the 4th unit reactor of the Chernobyl AES immediately before the accident demonstrated in the first approximation that operation of the emergency protection system in and of itself does not cause reactor runaway. On the other hand, operation of two of the four MCPs in each half of a running out turbogenerator can result in the development of a catastrophic process even without the effect of positive reactivity of old style displacing rods. Figures 5, tables 3, references 5: 4 Russian, 1 Western.

Prospects for Using Membrane Distillation for Processing of Liquid Radioactive Waste

947F0064C Moscow ATOMNAYA ENERGIYA CCDD94 in Russian Vol. 75, No.5, November 1993 pp 345-350

[Article by Yu.I. Dytnerskiy (RKhTU [expansion not given] imeni D.I. Mendeleyev, Yu.V. Karlin and V.N. Kropotov (MosNPO [Moscow scientific production associatio] "Radon"); UDC 621.593]

[Abstract] Membrane distillation is a promising method for deep water demineralization and purification. Its attraction for processing of liquid radioactive waste is in its capability of deep water purification and concentrating all impurities in one flow. The article presents results of studies aimed at determining the effect of various surfactants on the efficiency of water demineralization by membrane distillation, and determining the depth of radioactive water purification from ^{137}Cs, ^{90}Sr and ^{90}Y. It was found that membrane distillation was inefficient in purification or demineralization of water solutions containing surfactants unless surfactant molecules had been eliminated by some other means. It was also found that the use of membrane distillation made it possible to achieve a fairly high coefficient of purification of liquid radioactive waste and get a more concentrated brine. The article suggests implementation of the proposed method in a mobile unit for processing of liquid waste. Figures 3, tables 2, references 7.

Experimental Determination of Release of Solid Fission Products at Temperatures Simulating Emergency Situations at AES

947F0064D Moscow ATOMNAYA ENERGIYA CCDD94 in Russian Vol. 75, No.5, November 1993 pp 363-367

[Article by I.V. Zakrzhevskaya, G.V. Momot, A.V. Statkov, A.A. Khrulev and V.P. Shmelev (Atomic Reactors Institute, RNTs [expansion not given] "Kurchatovskiy institut"); received April 30 1993; UDC 621.039.548]

[Abstract] Nowadays great attention is paid to analysis of possible AES accidents caused by overheating of fuel that results in global destruction and meltdown of the core and release of fission products into the heat transfer agent and beyond the primary loop and AES protective shell. To provide reliable computer forecasts of accident development it is necessary to know information on release of long-lived fission products and use an adequate mathematical and physical model of fission products release under conditions that are typical for serious

accidents. Experimental studies of release of fission products in various media under different temperatures (up to the uranium dioxide melting point) have been conducted for several years at RNTs "Kurchatovskiy institut". The article presents results of measurements of time and temperature dependences of release of fission products such as ^{140}Ba, ^{140}La, ^{95}Zr, ^{103}Ru and ^{141}Ce when annealing irradiated specimens in an inert medium under conditions that simulate accident situations caused by overheating of reactor fuel. Results of test conducted in an active medium are being prepared for publication. The article describes the specimens and procedure used for determining release of solid fission products and presents experimental results. It was found that release increases along the Ce- Zr- La- Ba series. Figures 5, tables 3, references 4: 2 Russian and 2 Western.

Assessment of Environmental Effect of Enterprises That Handle Radioactive Waste

947F0064E Moscow ATOMNAYA ENERGIYA CCDD94 in Russian Vol. 75, No. 5, November 1993 pp 389-391

[Article by V.V. Verbov, O.G. Polskiy, Yu.V. Puzanov, I.A. Sobolev, N.I. Belova and L.F. Verbova (MosNPO [Moscow scientific production association] "Radon"); UDC 550.373]

[Abstract] Specialized enterprises that handle radioactive waste perform centralized collection, transportation, processing and burial of low and medium radioactive waste in various Russia and CIS regions. Their activity brings up questions of the possible effect on environment, personnel and population of adjacent territories. Radioecological inspections of 19 specialized enterprises were conducted in 1989-1993. The article presents a block diagram of operation of these enterprises, which actually shows a model of possible transfer of radioactive substances from an enterprise into environment. To obtain information on the radioecological status of the environment one studied γ radiation fields in various zones of each enterprise and the content of α and β emitting products and individual radionuclides in water, soil and vegetation. Results of the analysis for all specialized enterprises demonstrated that there was no noticeable effect on environmental objects. However, it is possible that this conclusion was the result of insufficient sensitivity of observation equipment, the small size of the statistical sampling and non-representative character of the samples. No correlation was found when a criterion based on the principle of independence of data related to different enterprises located far away from each other was used when the effect of radiation background was discounted. Within the error of measurement no environmental effect of the enterprises was found when using available procedures. However, one cannot consider this analysis as unbiased if one does not take into account radiation background data. Figures 2.

Damage of Output Collectors of Steam Generators at AESs With VVER-1000 Reactors

947F0064F Moscow ATOMNAYA ENERGIYA CCDD94 in Russian Vol. 75, No.5, November 1993 pp 391-394

[Article by V.I. Baranenko, V.S. Kirov, V.P. Kravchenko (Odessa Polytechnic University), V.A. Korovkin and N.A. Fridman (Rovno AES); received May 31,1993; UDC 621.184.25:621.181.192]

[Abstract] Fourteen AES power units with VVER-1000 reactors are currently operated in CIS countries. Each reactor has four steam generators, and 35 of those have already failed, after being in operation for less than one-quarter of their service life. While steam generators abroad fail due to corrosion damage of heat-exchange tubes, failures at AESs with VVER-1000 are caused by cracks in output ("cold") collectors. The work described in the article was aimed at finding causes of the cracks. Cartograms of damage at 23 steam generators that had been replaced at the Novovoronezh, Balakovo, Yuzhno Ukrayinskaya and Zaporozhye AESs were studied (there was no damage at the remaining AES. It was found that there was a certain regularity of crack location and pattern. It is concluded that the location of damages is determined by design features of the tube plate, on the one hand, and peculiarities of thermal and hydraulic processes in the steam generator, on the other. The damage is of fatigue type. Substantial thermal cyclicity, which affects the collector metal temperature, is caused by frequent PVD [expansion not given] shutoff. Figures 3, references 7: 5 Russian, 2 Western.

Skilled Workers Important to Economic Construction

947c0063 Beijing GONGREN RIBAO in Chinese 27 Nov 93 p 2

[Editorial: "Skilled Workers Are Important to Economic Construction"] [Text] The first ever China Youth Talent Olympics, jointly sponsored by nine units including the Ministry of Labor, the All-China Federation of Trade Unions, and the central committee of the Communist Youth League, came to a close after nearly three months of competition, with the outstanding achievements of skilled contestants in ten areas of industry providing a successful close to the competition. In June of this year, Jiang Zemin, Li Peng, Qiao Shi, and other leading comrades each made speeches in dedication at the opening ceremonies. Yesterday, the contest organizing committee distributed prizes to the winners in a solemn ceremony at the Great Hall of the People. Premier Li Peng and other leading comrades met with the winning contestants at Zhongnanhai. Throughout the course of the competition, leaders from every province, city, autonomous region, and industry showed heartfelt concern and support for the talented stars of labor. All of this amply demonstrates that our party and nation attaches a great deal of importance to our nation's working class, and in particular, to the vast number of young workers. The labor of our workers, and especially

that of our skilled workers, is the key link in transforming science and technology into productive force, and is an important foundation of economic growth. Without the labor of workers who possess high quality and skill, high quality products would be impossible, as would a soaring economy. Science and technology is social wealth, and operational skill is also social wealth. In a certain sense, they are important sources of wealth at a deep level. We can introduce superb technology, advanced equipment, effective management techniques, and the applicable experts from abroad, but, is it possible to introduce from abroad the vast numbers of skilled workers required for economic construction? The superb operational skills of talented workers can create incalculable social wealth that money cannot buy. For this reason, Comrade Jiang Zemin pointed out that, "skilled workers are the sine qua non of economic construction." This is something we must fully recognize.p Jp People can still remember back to the 1950's and 1960's when our nation was producing large numbers of skillful craftsmen and "masters of technology" like Li Ruihuan, Ni Zhifu, Hao Jianxiu, and Wang Chonglun. The "top notch work", "knack for getting the job done", and "work style" that these individuals demonstrated on the production line greatly enhanced product quality and production efficiency. Their diligent technical study and the superb skills they attained were of monumental value in promoting construction enthusiasm in the working classes throughout the nation. Countless "masters of technology" not only created huge amounts of material wealth for our society, but they created precious spiritual wealth for society as well. The party, the nation, and society as a whole attached enormous importance to these workers. Today there are 120 million enterprise employees and nearly 100 million township enterprise employees in China, with 170 million of these people being workers who are the main force behind the creation of material wealth in society. As science and technology and the economy all grow at a rapid pace, the demand for higher cultural and technical quality of workers grows stronger. Yet, if we look at the current situation in the worker ranks in China, we see that this demand is far from being met. Looking at the make up of our worker ranks, we find only 200,000 technicians and 2,000-plus highly skilled technicians. If we look at the proportions of skill capacities required for production, we find that our technician ranks should grow to one million workers. Heightening the technical quality of our worker ranks is indeed an urgent mission required for development of our national economy. Vigorous national development demands that, while we attach importance to and give full play to the role of the intellectuals, we also must attach importance to and give full play to the role of the skilled workers, and this applies with particular force to highly skilled workers. We must stress growth in the worker ranks, we must adopt various forms, we must pursue various routes, and we must accelerate the cultivation of the various specialized technical workers. We must create a social atmosphere that attaches importance to technical operational skills and that respects technical workers. Of course, singers, movie stars, and dancers are needed in society. But, if "these three stars are the only ones that shine", while the multitude of skilled workers and technical stars who create immense wealth for society are busy with their noses to the grindstone, working in obscurity, and getting the cold shoulder, or being condemned or denounced, how is society going to grow? We should pay more attention to shining the media spotlight of skilled workers, we should focus the camera lens and direct the pen more toward capturing the accomplishments of the skilled workers and technical stars, and we should let the people know that, without the contributions of our technical stars and skilled workers, our society would be floundering in emptiness as it chases its "stars." At the same time, we must call on leaders at every level to ardently show concern, to support, and to fully use and fully reward skilled workers and technical stars. This is an important measure that will prevent talent drain, safeguard the enthusiasm of skilled workers, and encourage skill growth and wealth creation on the job. Of course, further reform of an irrational labor wage system, destruction of the communal rice pot, and promotion of the social status of the skilled worker remain the fundamental ways to protect our skilled workers and induce young workers to study technical skills. p= pI hope that the "technical stars" and the ranks of the skilled workers in China expand into an enormous and powerful force. When large numbers of "technical stars" and skilled workers emerge, then the Chinese economy will enjoy sustained, rapid, and healthy growth. We look forward to this wonderful future!

Application of Thermal Emission Nuclear Electric Power Units in Spacecraft Energy Propulsion Complexes

947F0063A Moscow ATOMNAYA ENERGIYA CCDD94 in Russian Vol.75, No.4 October, 1993 pp 249-254

[Article by P.V. Andreyev, A.Ya. Galkin, G.M. Gryaznov, Ye.Ye. Zhabotinskiy, G.A. Zaritskiy, A.M. Nikonov, V.I. Serbin GP [expansion not given] "Krasnaya zvezda" and V.A. Usov (Nuclear Reactors Institute, RNTs [expansion not given] "Kurchatovskiy institut"); received Dec 29,1991; UDC 621.039.577]

[Abstract] The article examines construction principles of universal space platforms [USPs] using thermal emission nuclear electric power units [NEPUs] with thermal and fast reactors and electric reactive drives [ERDs] as applied to a "Proton" carrier rocket. Due to their compactness, the possibility to substantially increase the output during 15 to 20% of the total flight time, and small disturbances to spacecraft motion it is expedient to use thermal emission NEPUs in USPs. As far as their mass, overall dimensions, cost and performance characteristics are concerned, NEPUs have important advantages over photoelectric units. The article lists NEPU components and describes their parameters. Two versions of orbital injection are examined a single launch (the USP is launched into orbit together with the special purpose equipment module) and double launch (the USP and special) purpose equipment module are

launched independently and then joined in a radiation safe orbit. Power supply of the special equipment module can also be done remotely by directional power transmission in the centimeter wave band. Capabilities of a spacecraft with USPs using various capacity thermal emission NEPUs for a flight to a stationary orbit, wherein a "Proton" rocket is used for launching into a low (about 200 km) orbit and a special purpose acceleration module is used for transferring the spacecraft to a radiation safe orbit (around 800 km), are discussed. The mass and dimensions of the special purpose equipment module are estimated. The data presented in the article justify the promising character of application of power propulsion complexes with thermal emission NEPUs for solving practical problems of space exploration. Tables 2. references 5.

Prospects of Application of Thermal Emission Nuclear Electric Power Units for Material Manufacturing in Space

947F0063B Moscow ATOMNAYA ENERGIYA CCDD94 in Russian Vol. 75, No.4 October, 1993 pp 254-259

[Article by P.V. Andreyev, A.Ya. Galkin, Ye.Ye. Zhabotinskiy, A.M. Nikonov GP [expansion not given] "Krasnaya zvezda" and V.A. Usov (Nuclear Reactors Institute, RNTs [expansion not given] "Kurchatovskiy institut"); received Dec 29,1992; UDC 621.039.577]

[Abstract] Industrial scale material production in space opens up the possibilities of manufacturing semiconductor and optical materials, composites and medical preparations with substantially better properties. At present the most promising is space manufacturing of semiconductor materials for the electronic industry. The article lists factors that give thermal emission nuclear electric power units [NEPUs] advantage over solar power units and make NEPUs promising for the above applications and discusses possible concepts for using NEPUS in industrial spacecraft operating in a radiation safe orbit. Peculiarities of automatic loading and unloading, as well as manual loading and unloading by cosmonauts are examined, and possible radiation doses the cosmonauts could be exposed to are estimated. Remote power supply of industrial spacecraft will eliminate the radiation risk for the cosmonauts, and at the same time completely eliminate the NEPU effect on residual overloads. The analysis showed that if certain practically realizable conditions are observed thermal emission NEPUs can provide the required power supply for industrial spacecraft. References 4.

Estimated Effect of Novovoronezh AES Releases on Forest Planting

947F0063C Moscow ATOMNAYA ENERGIYA CCDD94 in Russian Vol. 75, No.4 October, 1993 pp 312-319

[Article by S.V. Fesenko, S.I. Spiridonov and R.M. Aleksakhin (All)Russian Agricultural Radiology and Agroecology SRI; received April 23,1993; UDC 577.539.12.04+581.539.12.04]

[Abstract] Because of high radiation sensitivity, high radio nuclide entrapment and slow self-cleansing capacity of trees, forest biogeocenoses are natural objects that are most vulnerable to exposure to ionizing radiation. The article examines possible radiation effects of releases of Novovoronezh AES on forest planting, because in the AES vicinity there are forests with various tree species, including coniferous species (at a distance of about 2 km from the AES). Estimates of the spectrum of probable AES effects on the forests can be considered typical for the majority of AESs in Russia and Ukraine, as well as in other countries. Dose loads on forest biogeocenoses located within a 30 km zone were calculated. The calculations took into account the forecast of changing radionuclide content in the near-ground atmospheric layer near the AES due to scheduled decommissioning of its 2nd, 3rd, 4th and 5th power units and several other engineering facilities and commissioning of the 6th and 7th power units. It was concluded that at present the Novovoronezh AES meets ecological safety requirements during normal operation. Effects of ionizing radiation from the maximum possible accident under the design conditions and the heaviest accident exceeding design conditions are analyzed. It is concluded that under certain AES accident scenarios radiation damage of adjacent forest planting is possible. This calls for conducting appropriate assessment during the design and construction of new AESs and for ecological control of operation of the existing AESs. Figures 4, references 12: 11 Russian, 1 Western.

Determination of Plutonium Content in Soil and River Bottom Deposits in Vicinity of NIIAR

947F0063D Moscow ATOMNAYA ENERGIYA CCDD94 in Russian Vol. 75, No.4 October, 1993 pp 319-324

[Article by Yu.N. Pospelov, Yu.V. Kuznetsov, V.K. Legin (NPO [Scientific Production Association] "Radiyevyy institut"), A.P. Kirillovich, I.G. Kobzar and V.P. Losev (NIIAR [Atomic Reactors SRI]); received December 19,1991; UDC 621.039.58]

[Abstract] Wide-scale work on manufacturing transplutonium elements and using them for manufacturing of radiation sources, as well as on using plutonium for manufacturing of experimental fuel elements and TVS [expansion not given] is being conducted at the NIIAR. The article presents results of studies conducted by NPO "Radiyevyy institut" and NIIAR on developing a procedure for and work conducted on determining the content of plutonium isotopes in samples of soil and river bottom deposits collected over the NIIAR territory and in the sanitary protection and observation zones. It lists basic requirements to analytical procedures for determining plutonium activity and shows a flow chart of the analysis used in the studies. The procedure validity was tested when analyzing IAEA samples Soil 6; the analysis error did not exceed 10% at a 0.95% confidence level. The samples were collected in the most representative points between June 19 and 26, 1989, and between June 11 and 15, 1990. No noticeable effect of NIIAR activity

on plutonium content in samples was detected. The studies showed that specific plutonium activity within 40 km of NIIAR was at the level of global activity for the Northern Hemisphere prior to the Chernobyl AES accident. Figures 1, tables 3, references 11: 7 Russian, 4 Western.

Fast Reactors With Lead Heat Transfer Agent

947F0058A Moscow ENERGETICHESKOYE STROITELSTVO in Russian No.6, 1993 pp 25-33

[Article by Engineers V.N. Leonov, A.G. Sila Novitskiy, V.S. Smirnov, A.I. Filin, V.S. Tsikunov and Yu.M. Cherkashov (NIKIET) under the "S&T Progress to Builders" rubric]

[Abstract] Work on "Nontraditional Concepts of AES With Natural Safety" is conducted within the framework of the State S&T Program "Ecologically Clean Power" under the auspices of the Ministry of Science, Higher School and Technical Policy. Criteria of inherent safety of nuclear reactors (a new nuclear power philosophy proposed by a well known American scientist A. Weinberg) had been developed, and a contest of concepts of nuclear reactors meeting these requirements was conducted. It has been determined that of the five concepts presented for the contest the concept of fast reactors with a lead heat transfer agent (BRFST [Russian abbreviation]) meets the requirements in the most thorough way. A group of IAE [Atomic Energy Institute] associates on the initiative and under the leadership of V.V. Orlov had begun the development of such reactor more than five years ago; the development then continued at NIKIET [expansion not given] and OKB [Experimental Design Bureau] "Gidropress", with the participation of FEI, VNIINM, TsNIIKM "Prometey", NIIAR, VNIITF [expansions not given], NPO [scientific production association] "Luch", MIFI [Moscow Engineering Physics Institute] and a number of other institutes. There are two directions of designing a reactor unit a three and a two loop scheme for removal of heat from the reactor core. The two loop scheme is deemed more promising. Conceptual designs of reactors BRS (300- 1000 MW of electric power) and BREST 300 (300 MW) are described. As far as the cost of electric power is concerned, it is lower for BREST reactors than for reactors BN 1600 and VTGR and comparable to reactors VVER. It is estimated that an experimental demonstration reactor can be built in approximately eight years, while construction of a pilot AES with this reactor will take 12 to 15 years. Three illustrations, two tables.

Normative Regulation of Safety in Nuclear Power Industry

947F0058B Moscow ENERGETICHESKOYE STROITELSTVO in Russian No.6, 1993 pp33-37

[Article by Candidate of Physical Mathematical Sciences O.M. Kovalevich and Candidates of Technical Sciences A.M. Bukrinskiy and V.P. Slutsker (S&T Center for Nuclear and Radiation Safety) under the "Problems, Search, Solutions" rubric]

[Abstract] The development of the nuclear power industry in the country can be conventionally split into three stages. During the first stage (first generation AES power units with reactors VVER-440 and RBMK 1000) normative regulation of safety was mainly based on the general industrial experience and experience in the development and operation of military nuclear units and research and experimental reactors. During the second period (second generation VVER 440 and RBMK 1000, and VVER 1000) problems of AES safety were dealt with more thoroughly, based on domestic and foreign experience in the development and operation of first generation AESs. At this stage construction of nuclear power units was governed by "General Safety Requirements for the Design, Construction and Operation of Nuclear Power Plants" (OPB-73), which on the whole corresponded to similar documents of other countries, for instance, to the then in effect U.S. "General Design Criteria for AES". In 1982 the OPB 73 was revised and replaced with OPB 82, but the safety concept practically had not changed. Also during this stage normative technical documentation (NTD) dealing with radiation safety of the operating personnel and population at large was developed. In 1987 a "Summary List and Plan for the Development of Rules and Standards Related to Nuclear Power" (SPPNAE 87) was approved. It took into account the available experience in the development and operation of nuclear equipment, as well as the consequences of the Chernobyl AES (1986) and Three Mile Island (1979) accidents. This third (current) period of the development of nuclear power is characterized by more stringent requirements to ensuring AES safety. As of 1990, OPB 88 replaced OPB 82. The work on OPB 88 coincided in time with the development of "Basic Principles of Ensuring Safety of Nuclear Power Plants" (INSAG-3) by the International Consulting Group on Nuclear Safety under the auspices of the IAEA General Director, which made it possible to take into account the international experience in solving problems related to ensuring safety. The article explains in greater detail the new safety concepts set forth in OPB-88 and describes work on the development of Integrated NTD that regulates problems of ensuring safety of dangerous nuclear and radiation facilities.

Restoration of Design Clearance Between Reactor Fuel Channels and Graphite Stacking in Leningrad AES First Power Unit

947F0058C Moscow ENERGETICHESKOYE STROITELSTVO in Russian No. 6, 1993 pp 38 -41

[Article by Engineers V.V. Andreyev, V.V. Vaynshteyn, Yu.V. Mostovoy, Yu.D. Zharkovskiy and M.F. Podlipalin (NIKIMT) under the "Problems, Search, Solutions" rubric]

[Abstract] The article deals with problems of improving the safety of RBMK reactors, particularly RBMK 1000. Due to the effect of the neutron flux the geometric shape and dimensions of graphite stacking blocks and fuel channels (FC) change the hole diameter of graphite blocks decreases, the graphite stacking contracts, and the FC diameter increases. The result decreased clearance between the FCs and graphite stacking. The design clearance between the FC and graphite stacking in the first unit reactor of the Leningrad AES decreased prematurely because the actual rate of change of the above parameters exceeded the design rate. A decision was made to replace all fuel channels and bore out graphite stacking holes for the channels. The repair work took 10 months and was done during a single reactor shut down. A technological process of restoring the clearance was developed; it is described in great detail. Repair equipment and fixtures were designed at NIKIMT, VNIIAES and TsNIITS [expansions not given] and LAES [Leningrad AES] and manufactured at NIKIMT, NIKIET, VNIIAES, NPO "Krasnaya zvezda", PNITI, FEI, TsKBM [expansion not given], LAES and IAE [Atomic Energy Institute] imeni Kurchatov enterprises. Main types of equipment used for the repair (the cutting mechanism, welding equipment and repair fixtures used for FC replacement and boring of graphite blocks) are described.

Computer Aided Design of Windmills

947F0062 Moscow ENERGETICHESKOYE STROITELSTVO in Russian No. 11, 1993 pp 69-73

[Article by N. S. Golubenko, G. M. Galimov, V. T, Perekhrest, A. P. Lozovskiy, A. V. Trubin, T. V. Andreyeva, V. Ya. Krivokorytov, A. V. Shipilevskiy, Yuzhnoye Design Bureau]

[Abstract] The Yuzhnoye design bureau has designed a number of windmills for energy production using CAD packages. The YeSKD package creates drawings and transmits information to other programs. It is based on AUTOCAD 10.0 and has a program package written in AUTOLISP. The ASSISTENT system automates the production of design documentation. SKHEMA designscircuitry and conduit for electrical, pneumatic, pneumatic-hydraulic, kinematic, and other types of systems. SPETSIFIK formulates specifications and uses guidebooksto standardize parts, materials and nomenclature. These program packages are general-purpose systems for machine building. Yuzhnoye developed a program to determine the aerodynamic properties of windwheels with a horizontal axis of rotation. The program is written in FORTRAN. The automated control system of one windwheel is described The problems of designing these systems are discussed. A proposal to construct a system to automatically regulate the angular velocity of a windwheel is discussed. Figures 2.

Рис. 1. Блок-схема программы расчета аэродинамических характеристик (АДХ) ветроколеса (ВК) с помощью ПЭВМ

Figure 1. Flow chart of program to determine the aerodynamic properties (ADP) of a windwheel (WW) with a PC.

Key (top to bottom): Flow chart of main program; input of initial data of design variants; input of parameters of graphic device; input of geometric parameters of support cross sections; input of ADP of WW profiles; determination of geometric parameters of calculated cross sections using linear interpolation between support cross sections; beginning of variants loop; calculation of blade cross sections using iterations method in the theory of elementary flows; do the iterations converge? (yes to side, no below); calculation of cross sections in turbulent flow mode; calculation of integrated ADP of WW; end of variants loop (no to side, yes below); output of results; end of program.

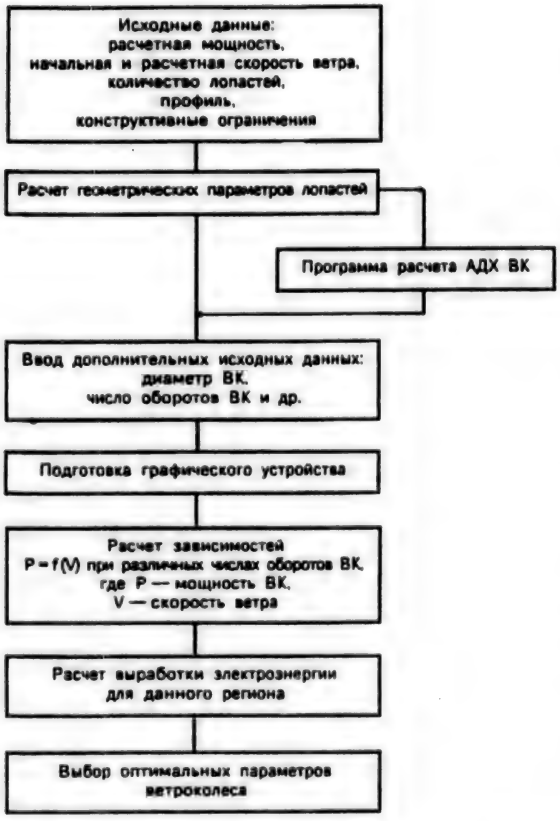


Рис. 2. Блок-схема программы расчета оптимальных параметров ВК

Figure 2. Flow chart of program to calculate optimal windwheel parameters.

Key (top to bottom): initial data: calculation of power, initial and calculated wind speed, number of blades, profile design limits; calculation of geometric parameters of blades; program to calculate ADP of WW; input of additional initial data: diamater of WW, number of revolutions of WW, etc.; preparation of graphic device; calculation of equations P = f(V) for various WW revolution numbers where P is WW power, V is wind speed; calculation of output of electric energy for a given region; selection of optimal WW parameters.

Kvint Hardware-Software Complex

947F0054 Moscow TEPLOENERGETIKA in Russian No. 10, 1993 pp 2-10

[Article by Cand. Tech. Sci. N. M. Kurnosov, Cand. Tech. Sci. V. V. Pevzner, Cand. Tech. Sci. A. G. Ulanov, and Engineer Ye. A. Yakhin, Scientific Research Institute of Thermal Instruments; UDC 62-5.681.2]

[Abstract] As the lead organization, the Scientific Research Institute of Thermal Instruments is developing the Kvint computer system for computerizing the engineering processes at heat-and- electric power stations. Kvint represents one of the first functionally complex domestic systems of its kind and computerizes the collection and preliminary processing of information, engineering process control, logic-program control, priority control, locking, online control, alarming, information archival, event recording, calculations offline, and information transfer. The system is based on a problem-oriented approach, distributed automatic control, centralized monitoring, object-oriented control, production programming, self-diagnosis and sample redundancy, and project configuration. Kvint has a four-level architecture—field, controller, systems, and production—each level of which uses its own local network or several similar networks. The development is proceeding in two stages, with design bureaus from Ivano-Frankovsk, Cheboksary, and Moscow taking part. The Moscow- based All-Russian Heat-Engineering Institute is developing the hardware requirements for the Seriya 200, the first stage of the development. Figures 3.

Improvement of Pumping Stations

947F0067B Moscow UGOL in Russian No.11, 1993 pp 36-37

[Article by G. I. Puzikov, I. V. Taratynov, Giprouglemash; UDC 621.651:622.232.8]

[Abstract] Giprouglemash and the Bryansk Machine Building Company are designing pumping units and stations for mechanized supports, water removal systems, water injection units used in coal beds, and high-pressure irrigation systems. The series of pumping stations features pressures from 20-63 MPa, and a delivery rate of 30-400 l/min. The series has 22, 37, 55, and 110 kW models. Gravitational extraction is used in the filtering system. These pumping stations consume less power than their predecessors and are half the weight. Their most vulnerable parts (for example, the plungers) are reinforced for a longer lifetime. Figures 2.

Ideas on the Transition to Automated Technology in Mineral Extraction

947F0067A Moscow UGOL in Russian No.11, 1993 pp 34-35

[Article by I. S. Krashkin, V. I. Ivko, Skochinskiy Institute of Mining and Insistemshakht Institute; UDC 658.52.011.56.012.3:622.232.001.4]

[Abstract] Traditional means of mechanizing and automating existing technology have been exhausted. The creation of robotic equipment (primarily manipulator arms) to perform extraction operations is described. The use of robotics can sharply increase mechanization of mining operations in the entire extraction area, automate monitoring and control operations, and determine the actual efficiency of use of cutting machines, and the adaptability of machines for complex geological and mining conditions. The difficulties in replacing a human operator, primarily human cognitive functions are discussed. It is noted that all the pieces are in place for the use of robotics, but they have yet to be applied to mining operations.

On Additional Requirements to Structures of Seismically Stable Thermal Power Plants

947F0057A Moscow ENERGETICHESKOYE STROITELSTVO in Russian No.6, 1993 pp 55-57

[Article by Engineer N.I. Sobolev (Teploelektroproekt, Moscow) and Candidate of Technical Sciences G.G. Karpov (Rostovteploelektroproekt)]

[Abstract] Scientific research and design planning work aimed at development of seismically stable thermal power plants and electric power networks is conducted by Teploelektroproekt in cooperation with VNIIG imeni B.Ye. Vedeneyev, Rostovteploelektroproekt and Energosetproekt. The first draft of additional requirements to the design of TPPs [thermal power plants] located in seismic areas has been developed. The work was necessitated by a substantial increase in the frequency of seismic activity in earthquake prone regions of the country where thermal power plants operate, are being built or scheduled for construction. Analysis of the effect of the 1988 Spitak earthquake on power generating facilities corroborated the need for this work. Causes of earthquake caused damage to power plants were determined, and specific ways to improve seismic stability of their buildings and facilities have been outlined. Foreign experience was also taken into account. The additional requirements have been substantiated. At present a TPP is considered seismically stable if it remains ecologically and technologically safe in a maximum rated earthquake (MRE) with a once in a 1000 years probability and provides uninterrupted supply of electric power and heat after a design earthquake (DE) with a once in a 100 years probability. Because TPP buildings and facilities have different functions, a differentiated approach to designing them for seismic stability is used. However, it is suggested that it is more expedient to design all TPP buildings, facilities and equipment for the same level of seismic action with the frequency of once every 100 years. Based on the analysis and results of the work 13 additional requirements are presented.

MECHANICS OF GASES,LIQUIDS AND SOLIDS

On Oscillations of Massive Buried Plate on Orthotropic Medium Surface

947F0065 Moscow IZVESTIYA ROSSIYSKOY AKADEMII NAUK: MEKHANIKA TVERDOGO TELA in Russian, No.6, 1993 pp 68-73

[Article by A.O. Vatulyan and I.M. Syunyakova (Rostov-on Don); received May 8,1992; UDC 539.3]

[Abstract] Dynamic contact problems of isotropic and anisotropic theory of elasticity for massive and weightless dies lying on the surface of a medium simulated by either a layer or half-plane have been studied in sufficient detail. This type of problems are topical in foundation construction, vibroseismical prospecting and when designing various critical structures operating under complex dynamic conditions. But taking into account the actual plate depth and anisotropy of the foundation call far a different approach based on the method of boundary integral equations. The article examines the problem of steady state oscillations of a massive die connected to a foundation that is an orthotropic half-plane with an uneven boundary; in a particular case the die can be embedded into the half-plane to a certain depth. The derived special basic solutions make it possible to formulate boundary integral equations (BIEs) for the finite portion of the half-plane boundary. The use of a classic version of the boundary elements method with the simplest approximation of contact stresses makes it possible to reduce the resulting BIE system to a linear algebraic system. Results of calculations for various frequencies depending on the number of elements used. Figures 2, references 8.

Natural Climatic Changes in Western Siberia to 2000

947N0030A Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian Vol. 35 No. 1, Jan 94 pp 3-21

[Article by S. A. Arkhipov, V. S. Volkova, V. A. Bakhareva, M. R. Votakh, T. P. Levina, S. K. Krivonogov and L. A. Orlova, Joint Institute of Geology, Geophysics and Mineralogy, Siberian Department, Russian Academy of Sciences, Novosibirsk; UDC 551.582(571.1)]

[Abstract] A predictive scenario of landscape-climatic conditions to the year 2000 is proposed for Western Siberia. It is based on the principle of paleoclimatic analogues, establishing a correlation between the concentrations of carbon dioxide gas in the atmosphere and in the ocean surface layer and the Earth's global temperatures. The results of chronostratigraphic and paleobotanical studies are used in reconstructing the landscape-climatic conditions of the Holocene climatic optimum which prevailed in Western Siberia about 5500 years ago because due to the anthropogenic factor it is expected that by 2000 the CO_2 level will be restored to the conditions observed there during that time. The natural climatic changes in Western Siberia, like those for Siberia as a whole, fit in quite well with global environmental changes. The climatic rhythm established for the Holocene, as well as definite refinements obtained using specifically Siberian materials, make possible a quite reliable prediction of the nature and direction of natural climatic processes in the near future. The natural trend, giving evidence of progressive cooling, very probably was disrupted in the 1970's by the anthropogenic factor leading to global warming. The climate is becoming milder, in northern Siberia warmer and moister, whereas in the south, in arid steppe regions, it is becoming moister. The transformation of landscapes, vegetation zonality, permafrost, variations of river runoff and lake levels will occur with a definite lag because the rate of anthropogenically induced climatic conditions exceeds the natural trend by tens or hundreds of times. How soon serious deformations of natural systems will begin will evidently be dependent on the climatic trend in the 21st century. Figures 6; references 47: 42 Russian, 5 Western.

Ionospheric Disturbances Caused by Launching Rockets Carrying Payloads Into Orbit

947ND0028A Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY FIZIKA in Russian Vol. 36, No. 10, Oct 1993, pp 98-107

[Article by P. M. Nagorskiy and Yu. Ye. Tarashchuk (no affiliation indicated; UDC 550.388.2]

[Abstract] Vertical and inclined sounding methods were utilized to study artificial ionospheric disturbances caused when payload-carrying rockets are launched into near-earth orbit. The data used in the study were gathered from dozens of launches. Long-lasting artificial ionospheric disturbances recorded by vertical sounding were discussed first. A series of 46 ionograms taken from an ionospheric station located in Karaganda, Kazakhstan, revealed that additional and unusual tracks appeared on the ionograms after a launch, and the relative frequency, quantity, and duration of the tracks depended on the time of year and the time of day. It was emphasized that, as a rule, the additional reflections only appeared during daylight hours. An explanation was provided for the absence of the additional tracks at night, and it was concluded that no long-lasting positive deviations of the electron concentration from background levels were detected. The causes of negative disturbances in the electron concentration were then addressed. The ionograms recorded in this part of the study looked very much like those obtained when the ionosphere is modified by chemical agents. The second part of the paper discussed the use of short-wave Doppler inclined sounding of artificial ionospheric disturbances. The short-wave signals were transmitted in unmodulated carrier mode by broadcast transmitters. The signal parameters were recorded simultaneously on up to eight frequencies on a synthesizer-type receiver located in Tomsk. The signals of the second intermediate frequency were mixed with a reference signal with the same frequency plus a base frequency component of several hertz (e.g., 215 kHz + ΔF). The characteristics of the disturbances and the dynamics of their development were described, illustrated, and mathematically modelled. The results of the ionogram study were fundamentally consistent with the results of the inclined sounding study. Figures 5, tables 1; references 27: 19 Russian, 8 Western.

Regionalization of Russia According to Degree of Environmental Degradation

947N0026A Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA: SERIYA 5—GEOGRAFIYA in Russian, No. 6, Nov-Dec 1993 pp 22-31

[Article by M. Yu. Belotserkovskiy, T. M. Belyakova, K. M. Berkovich, G. I. Gladkevich, M. N. Gubanov, Ye. F. Zorina, A. N. Kosarev, G. A. Larionov, B. A. Semenchenko, R. S. Chalov, A. V. Chernov; Geographical, Geological, Cartographical, and related departments at Moscow State University; UDC 574:911.6(470)]

[Abstract] Members of the geography department at Moscow State University were commissioned by Russia's Ministry of Environmental Protection to draw up a map dividing Russia into regions according to their degree of environmental degradation and human morbidity. Environmental degradation, or "stress," was broadly defined as anthropogenic or natural ecological deterioration sufficient to interfere with normal human activity. Different sets of criteria were developed and elaborated for land, marine, and river ecosystems. These criteria were not considered exhaustive. The different regions were ranked on a scale of 0 to 5, with 0 representing environmentally pristine regions, and 5 representing regions with severe environmental problems.

None of the regions were considered environmental disaster areas. An analysis of the map yielded the following conclusions: 1) Most of Russia is not suffering from appreciable environmental degradation, including the northern zone of European Russia; 2) No regions were given a ranking of 5, with the exception of some major reservoirs; 3) Regions with a ranking of 4 were found only in European Russia; 4) Regions of moderate environmental stress (up to a ranking of 2) were found in territories that were otherwise considered to have few or no environmental problems. Analogical conclusions were drawn for river systems, inland seas, and coastal waters. A considerable number of geographical locations were explicitly identified, regardless of the degree of environmental damage. No direct correlation was found between human morbidity indices and the degree of environmental degradation, with the exception of areas with exceptionally high morbidity rates, the causes of which were too complex for the scope of this study. Figures 1.

AGRICULTURAL SCIENCE

New Technologies of Rice Growing on High Saline Soils (NTOZ)

947C0077A Alma-Ata IZVESTIYA AKADEMII NAUK RESPUBLIKI KAZAKHSTAN: SERIYA BIOLOGICHESKAYA in English No. 4, Jul-Aug 92 pp 11-15

[Article by J.U. Akhanov, V.A. Korniyenko, J.U. Mamutov, Soil Science Institute at the Kazakh Republic's Academy of Sciences, Almaty; UDC 631.619]

[Abstract] The great length of excess toxic salt removal from the soil in rice growing areas (requiring four-to-six years to reach the necessary fertility) and the eventual resalinization process which requires periodic repeat treatment prompted the development of new rice growing practices on high-saline salts. The use of the new method developed at the Soil Science Institute at the Kazakh Republic's Academy of Sciences (NTOZ) is based on using the synergy effect of the new low-volume ameliorating agents which alleviate boric toxicosis in the soil and plants, eliminate the pathogenic microorganisms, and normalize the nutrition conditions. The new practices make it possible to inactivate the harmful impact of elementary salts, thus leading to higher and biologically more valuable yields of rice and other rice rotation crops on highly saline soils and salt marshes without washing them beforehand. They are also applicable to nonsaline calcareous soils in the arid zone. The new methods are implemented by traditional agricultural procedures used in rice growing. In NTOZ, the permissible level of soil salinity is 15-20 times higher than in conventional rice growing practices while the rice vegetation period is shortened by 10-12 days. The NTOZ method does not call for new flow or spillway systems, special fertilizers, or special tilling procedures. Tables 2.

Appearance of Sunflower Stem Brown-Spot in Russia

947C0141A St. Petersburg MIKOLOGIYA I FITOPATOLOGIYA in Russian Vol. 27 No. 5, Sep-Oct 93 (manuscript received 27 Apr 93) pp 68-73

[Article by V.I. Yakutin; UDC 632.4:633.854.78]

[Abstract] In the past few years, the new disease stem brown-spot, which is caused by the fungus *Phomopsis (Diaporthe) helianthi)*, has been appearing on sunflowers in Western, Central, and Eastern Europe. The disease has been referred to by various names, including sunflower phomopsis in the Western literature. Sunflower stem brown-spot was first detected in Russia in the Stavropol Kray in 1990. Foci of the disease have since been recorded in the other regions of the Stavropol and Krasnodar krays, Kabardino-Balkaria Republic, and Rostov Oblast of the Central Caucasus and in three oblasts in the Central Chernozem region. Mycological and phytopathological analyses of specimens of brown-spot-infected sunflower stems collected throughout the affected regions confirmed *Ph. helianthi*, which was first identified as the cause of sunflower stem canker in Yugoslavia in 1981 and first detected in the former USSR in 1985, to be the causative agent. Studies have shown that one of the reasons for the appearance of stem brown-spot now is the fact that infected seed material from affected regions of the former USSR are still being used. Further spread of the disease through contaminated seed material is also likely. *Ph. helianthi* has a definite variability that is manifested in pure cultures in the form of different colorations of the mycelium, in the formation of two types of spores in the pycnidium (α- and β-spores in the strains A and B, respectively), and in variation of its pathogenic properties to sunflower specimens. Strains with α- and β- spores in their pycnidia have been established to have a similar pathogenicity upon artificial inoculation. Both strains have shown definite intraspecial physiological and morphological diversity. *Ph. helianthi* thrives at higher temperatures than other sunflower pathogens (*Sclerotinia sclerotiorum* and *Botrytis cinerea*) do. In various nutrient media, *Ph. helianthi* growth and spore formation are most intense between 20 and 25°C. Growth and development of the fungus are sharply inhibited by 30°C, and they cease completely at 35°C. Field studies have shown the disease to be most intense at air temperatures of 10 to 20°C with absolute temperature fluctuations from 5.6°C at night to 28.3°C during the day. The most effective preventive measures appear to be the use of resistant varieties and the use of fungicides. Russian research to protect sunflowers against the disease has been extremely limited. The sunflower lines VIR 130 and VIR 160 and the hybrid Krasnodarskiy 885 appear to have the highest resistance to stem brown-spot, whereas the varieties Berezanskiy, Yenisey, and Ultraskorospelyy appear to have the lowest resistance. Studies conducted abroad have established several fungicides that appear to be effective against the disease. The fungicides Ronilan and Rovral have been approved for use on sunflowers in Russia. Fungicides should be applied to sunflowers three times: before they button, when or soon after they first flower, and at the end of flowering. Tables 5; references 13: 8 Russian, 5 Western.

BIOTECHNOLOGY

Structural-Functional Angiotensin II Molecule Arrangement. 1. Structural Problem

947C0082A Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol. 19 No. 5, May 93 pp 517-535

[Article by T.V. Gogitidze, Ye.M. Popov, National Correspondence Food Industry Institute, Moscow; UDC 547.963:541.6]

[Abstract] The lack of general understanding of the receptors involved, the structural arrangement of natural peptides, and molecules' conformational capabilities which characterize recent studies of the physiological

mechanism of natural oligopeptides and especially peptide hormones necessitated a search for a direct relationship between the chemical structure and physiological action. As a consequence, a new approach to studying the biological activity of natural oligopeptide whereby the investigation proceeds from the structure to the function, i.e., in a direction opposite to that of existing approaches, was developed by the authors. It is rooted in the understanding of the structural arrangement of the low-molecular peptide molecules, a direct correlation between the conformational capabilities of a number of peptide hormones and their physiological action, and an assumption of the principal similarity of the physical and chemical origin of the hormone-receptor and enzyme-substrate interactions. The natural oligopeptide structural-functional organization principles underlying the approach are outlined. The study pursues two goals simultaneously: to establish the structural-functional arrangement of the angiotensin II molecule with the help of a known approach to examining natural oligopeptides (a more particular task) and testing the approach used in the specific analysis and assessing its actual capabilities (a more general task). The study shows that the angiotensin II molecule organization is, in essence, described by a set of low-energy conformational states of several groups which are easily transformed one into another. The two most energy- and entropy-wise efficient groups are identified and the geometrical parameters of their representatives are summarized. The values of the dihedral angles of the backbone and side amino acid hormone residual chains are calculated, and the energy of the intra- and inter-residual interactions of all potentially physiologically active conformations is evaluated. The findings are compared to numerous published sources. Figures 5; tables 7; references 45: 13 Russian, 32 Western.

Production and Identification of Monoclonal Antibodies to N-Acetylglucosaminyl-(β1-4)-N-Acetylmuramyl-Alanyl-*D*-Isoglutamine

947C0082B Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol. 19 No. 5, May 93 pp 555-561

[Article by T.Yu. Mareyeva, O.V. Kotova, Ye.A. Makarov, T.M. Andronova, B.A. Nesmeyanov, Bioorganic Chemistry Institute imeni M.M. Shemyakin and Yu.A. Ovchinnikov at Russia's Academy of Sciences, Moscow; UDC 57.083.3]

[Abstract] The immunomodulating properties of muramyldipeptide (MDP)—a minimal structure of the bacterium cell wall—capable of substituting for the microbacterial component and affecting the central nervous system and a lack of complete understanding of the molecular principles of the effect of muramyl peptides (MP)—a glycopeptide which contains muramic acid—prompted the development of an original approach to studying the receptors of biologically active ligands with the help of anti-idiotypic antibodies. To utilize this approach to examining the muramyl peptide receptor, an attempt is made to produce monoclonal antibodies to N-acetylglucosaminyl-(β1-4)-N-acetylmuramyl-alanyl-*D*-isoglutamine (GMDP)—a biologically active analogue of muramyldipeptide—for subsequent use of these antibodies for producing anti-idiotypic antibodies to GMDP. The GMDP conjugates to MeBSA and poly[(*D, L*-Ala)$_n$ Lys] (GMDP-AL) were synthesized in the peptide chemistry lab of the Shemyakin Institute while the GMDP conjugate to ovalbumin (GMDP-OVA) were produced using water-soluble carbodiimide (EDAC) according to Bahr, Garelli, *et al.* A prolonged immunization procedure was selected for immunizing mice with the GMDP-MeBSA conjugate. The hybridoma E6/1.2 line was produced by fusing splenocytes of mice immunized with the GMDP conjugates to methylated bull serum albumin (MeBSA) and cells of the SP2/0 myeloma line. The E6/1.2 line is capable of producing monoclonal antibodies to GMDP. The E6/1.2 MCAs are classified as belonging to the IgG1 subtype and have an affinity constant to GMDP of $2 \cdot 10^9$ M^{-1}. Based on data of a competitive enzymatic immunoassay analysis, the GlcNAc(β1-4)-MurNAc carbohydrate fragment and the first amino acid, i.e., alanine, make the largest contribution to these antibodies' interaction with GMDP. The conclusion is drawn that E6/1.2 MCAs are highly affine and interact specifically with GMDP, making it possible to use them for producing hybridoma which, in turn, produce monoclonal anti-idiotypic antibodies simulating the spatial GMDP structure. Figures 3; references 19: 3 Russian, 16 Western.

New Type II and IIs Restriction Endonucleases From *Bacillus* Genus Thermophilic Bacteria

947C0082C Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol. 19 No. 5, May 93 pp 583-585

[Article by V.Ye. Repin, G.D. Serov, L.I. Puchkova, T.A. Tereshchenko, L.R. Lebedev, V.Ye. Chizhikov, Scientific Research and Design Institute of Biologically Active Substances at the Vektor Scientific Production Association, Berdsk, Novosibirsk oblast, and VALPEC Ltd. Joint Stock Company, Novosibirsk; UDC 577.152.314]

[Abstract] Continuing interest in finding new restriction endonucleases aimed at discovering new prototypes or more practicable isoschizomers prompted a study of approximately 200 strains isolated by routine methods from the soil in various regions throughout Russia. The strains were selected on the basis of the following criteria: the thermophilic property of the bacteria, the ability to generate endospores, and the possibility of using conventional and easily available nutrient media, such as RPA and RPB, for cultivating microorganisms. The experimental procedure is described. As a result, 26 feasible products of restriction endonucleases were isolated; recognition sequences were identified for all 26 products and cleavage sites—for 15 of them. It is demonstrated that the enzymes are isoschizomers of the following known endonucleases: *Bst*NI, *Ear*I, *Hae*III,

*Hpa*II, *Cfr*10I, *Bsi*YI, *Bcl*I, *Bbv*II, *Bbv*I, *Bst*EII, *Bsa*BI, *Bsr*I, *Fsp*I, *Cla*I, and *Sfe*I. The findings make it possible to assert that thermophilic bacteria of the *Bacillus* genus are a promising source of restriction endonucleases. Tables 1; references 5: 4 Russian, 1 Western.

Synthesis of Interleukin-1 Receptor Antagonist Gene Using Polymerase Chain Reaction

947C0082D Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol. 19 No. 5, May 93 pp 586-587

[Article by Ye.N. Lebedenko, Yu.A. Berlin, Bioorganic Chemistry Institute imeni M.M. Shemyakin and Yu.A. Ovchinnikov at Russia's Academy of Sciences, Moscow; UDC 577.214.3]

[Abstract] The diversity of biological activity of interleukin-1 (IL-1) which is a mixture of two polypeptides IL-1α and IL-1β and can serve as a mediator of various diseases as well as host's protective mechanisms prompted renewed interest in the recently characterized protein factor—a natural IL-1 receptor antagonist (IL-1ra) which specifically blocks IL-1 binding to receptors in T-cells and fibroblasts but does not bind to IL-1 proper and does not have its biological activity. With respect to the foregoing, an attempt is made to investigate the possibility of developing a plasmid construction which contains the IL-1ra gene and is suitable for oriented mutagenesis and expression in prokaryotic systems. To this end, a mature IL-1ra gene is constructed with the help of a polymerase chain reaction (PTsR) using the mRNA cDNA hybrid as a template. The experimental procedure of constructing a primer and synthesizing the gene is described in detail. Two *in vitro* recombinations using the resulting mutant DNAs on the *Kpn*I/*Eco*47III and *Eco*47III/*Hin*dIII sites with recloning into the pDR540 expressing vector which does not contain the *Kpn*I site made it possible to eliminate mutations causing amino acid substitutions and produce a gene which precisely encodes the earlier described 152-link sequence of mature IL-1ra. The authors are grateful to S.A. Ketloinskiy, Ye.I. Shvarts, O.K. Kaboyev, and O.V. Plutalov for help with preparations and synthesis. References 11: 1 Russian, 10 Western.

Silochrome-2 Microspherical Aerosilica Gel: Highly Efficient Carrier for Solid Phase Oligonucleotide Synthesis

947C0082E Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol. 19 No. 5, May 93 pp 589-592

[Article by I.Ya. Dubey, T.V. Lyapina, D.M. Fedoryak, Bioorganic Chemistry and Petrochemistry Institute at the Ukrainian Academy of Sciences, Kiev; UDC 577.113.6:542.95]

[Abstract] The urgency of selecting an effective polymer carrier for solid phase oligonucleotide synthesis and the high cost of Porasil, Fractosil, etc., HPLC silica gels prompted attempts to synthesize a highly effective carrier for solid phase oligonucleotide synthesis on the basis of the easily accessible domestic microspherical aerosilica gel—Silochrome-2 with a synthetic spacer group. The particle size, specific surface, and mean pore diameter of silicate carriers for solid phase oligonucleotide synthesis are summarized, and the factors which determine their effectiveness are outlined. The carrier has sufficient mechanical strength and can be successfully used in automatic synthesizers. The specific requirements imposed on the spacers are discussed, and it is noted that spacer groups containing longer aliphatic fragments bend more easily and "stick" to the polymer's hydrophobic surface, thus shortening the distance between the oligonucleotide and the carrier and decreasing its effectiveness. Consequently, a spacer group with a shorter fragment—ehtylenediamine—and a carrier synthesis method are developed, and the aerosilica gel amination procedure is outlined. The resulting carriers have a close-to-optimum 25-35 μmole/g capacity resulting in a condensation reaction yield of 97.5-99%. The performance of the proposed carrier fully corresponds to best known carriers on the basis of the CPG porous glass, yet the new material is much cheaper and more easily available. The proposed spacer design also ensures high yields and purity. The authors are grateful to G. Panasenko for proving a Silochrome-2 sample. Figures 1; tables 1; references 11: 2 Russian, 9 Western.

Cyclic Nucleotides and Inositol Triphosphate as Biochemical Modulators of Permeability of Ion Channels in Receptor Domains

937C0094A Moscow BIOKHIMIYA in Russian Vol. 58 No. 1, Jan 93 [manuscript submitted 20 Feb 92] pp 81-97

[Article by S. A. Talako, Institute of Toxicology, Russian Ministry of Health, St. Petersburg; UDC 577.352.4]

[Abstract] The work reported here is based on the assumption of dynamic domain organization of receptor molecules in biological membranes. According to that concept, the receptor molecules are structural elements of the cyclic process of the formation and decay of receptor domains, and they catalyze biochemical cell transformations, transport substances across membrane barriers, and generate cyclic electrical and biochemical changes. Cyclomononucleotides and inositol triphosphate operate as biochemical modulators of ion-channel permeability by blocking Ca- binding centers of gate mechanisms of receptor-domain ion channels, thereby mobilizing Ca^{2+} ions in the cell from intracellular calcium depots and from the surrounding medium. Kinetic diagrams of the operation of the gate mechanisms are provided for instances in which ions or molecules capable of blocking just one Ca-binding center are present along with the Ca^{2+} ions. Figures 7, references 44: 6 Russian, 38 Western.

Possibility of Utilizing Various Types of Fruit and Vegetable Raw Materials for Microbial Lysine Synthesis

947C0066B Moscow PRIKLADNAYA BIOKHIMIYA I MIKROBIOLOGIYA in Russian Vol. 29 No. 4, Jul-Aug 93 pp 575-579

[Article by V.V. Trifonova, N.I. Ignatova, T.B. Milyukova, M.B. Overchenko, L.B. Rimareva, National Scientific Research Institute of Food Biotechnology, Moscow; UDC 668.394:636.087.1]

[Abstract] The irreversible chemical processes occurring in molasses during storage which make them unsuitable for use as a carbon source in lysine production by microbiological methods and reports that molasses can be easily substituted with acetic acid and cereals and fruits and vegetables as well as the urgency of developing new feed lysine production methods using nonstandard fruit and vegetable raw materials prompted an investigation into the possibility of producing lysine by bioconversion of various types of fruit and vegetable raw materials. To this end, the *Brevibacterium* sp. culture cultivated in 750 ml bulbs containing 25-30 ml of nutrient medium in a circular rocker spinning at a 220-240 RPM speed for 24-72 h was used. The experimental procedure is outlined. The quantity of lysine forming during fermentation was measured by thin layer chromatography. The carbohydrate composition of the fruit and vegetable media, the outcome of lysine biosynthesis in media with various carbohydrate concentrations, and a comparative characterization of the lysine development process in media from fresh and long-stored raw materials (apples, carrots, beats, cabbage, and various combinations thereof) are summarized. The study demonstrates that various types of such raw materials may indeed be used as the substrate for microbial synthesis of lysine from the *Brevibacterium* sp. culture and shows that bioconversion occurs at a varying degree of effectiveness. Complex media ensuring a high level of substrate conversion into lysine are selected. An analysis confirms that any plant raw material can be used successfully for producing lysine. The new method makes it possible to solve the problem of fruit and vegetable waste utilization, reduce environmental pollution, and supply a valuable animal feed supplement. Tables 3; references 5: 4 Russian, 1 Western.

Citric Acid Synthesis from Glucose During Continuous *Aspergillus Niger* Fermentation

947C0066A Moscow PRIKLADNAYA BIOKHIMIYA I MIKROBIOLOGIYA in Russian Vol. 29 No. 4, Jul-Aug 93 pp 567-574

[Article by P.B. Avchiyeva, A.Yu. Vinarov, I.A. Kozlova, National Scientific Research Institute of Protein Compound Biosynthesis, Moscow; UDC 576.8.095]

[Abstract] Extensive uses of citric acid—an important organic acid for the food, medical, and pharmaceutical industries—due to its low toxicity and easy metabolism and the advantages of glucose in citric acid production by fermentation are noted; moreover, the use of glucose during *Aspergillus niger* fermentation greatly facilitates research into the patterns of citric acid biosynthesis under continuous fermentation. Today, the Charles Pfizer Inc. and Miles Laboratories Inc. companies, both in the United States, are the largest citric acid producers. Despite considerable successes in the citric acid production methods by periodic fermentation, search is underway for a continuous method utilizing both *A. niger* and n-paraffins with *Candida lipolytica*, yet persistent problems of the continuous cultivation method, e.g., a drop in the citric acid concentration in the medium with a transition to continuous operation, prompted a comparative study of the biomass and citric acid biosynthesis by the *A. niger* culture from glucose under periodic and continuous fermentation. To this end, the *A. niger* fungus is used. The cultivation procedure is outlined. It is noted that in order to optimize the nutrient medium composition and avoid precipitating heavy metal salts thus eliminating the possibility of using the fungal biomass as a feed additive, the fungus was cultivated in a specially selected water-mineral medium containing glucose as the carbon source. The citric acid biosynthesis yield under these conditions depends on the cell concentration in the medium, the medium dilution rate, and diffusion properties of the culture. The study reveals the possibility of realizing two-stage fermentation: a biomass accumulation stage and induced citric acid excretion stage. The latter is facilitated by dimethylsulfoxide which is continuously added to the medium at the second fermentation stage at a 0.5% concentration. As a result, the citric acid concentration is higher that after conventional two-stage cultivation without induced excretion. The findings make it possible to develop stable and intensive citric acid production. Figures 9; references 13: 7 Russian, 6 Western.

Genetic Damage in Laboratory Mice Exposed in Chernobyl Nuclear Power Plant Area Four Years After Accident

947C0068E Moscow GENETIKA in Russian Vol. 29 No. 2, Feb 93 pp 312-322

[Article by A.V. Chekhovich, M.D. Pomerantseva, L.K. Ramayya, V.A. Shevchenko, General Genetics Institute imeni N.I. Vavilov at Russia's Academy of Sciences, Moscow; UDC 575.224.23.3.46:599.323]

[Abstract] Earlier mammal studies aimed at evaluating the genetic consequences of the elevated radiation background in the Chernobyl nuclear power plant area are continued, and the genetic variations in mice exposed in 1989 to 14-, 22-, and 34-day irradiation within the 10-km Chernobyl nuclear power plant zone are examined; an attempt is made to investigate the dependence of the genetic effect in sex cells on the exposure duration, animal hemotype, and the ontogenesis stage affected by the exposure. To this end, (CBAxC57BL)F_1 hybrid mice of both sexes and sexually mature C57BL males in wire mesh cages are studied at a surface dose (measured by a

DP-5 radiation monitor) averaging 60 mR/h. In addition, DTG-4 and MKDT radiation monitors were used for determining the absorbed γ-radiation dose and the cumulative absorbed γ- and β-radiation. The genetic effect of radiation on the sex cell was evaluated by the dominant lethal mutation (DLM) rate characterized by the embryo mortality before and after implantation; by the frequency of abnormal spermia heads (AGS), and by the rate of reciprocal translocations (RT) induced at the diakinesis stage. The study reveals a linear dependence of the induced effect on the absorbed dose magnitude. Among the animals irradiated during the embryonic development period, a male who is heterozygotic with respect to the reciprocal translocation is identified. No unambiguous relationship between the genetic effect and mice genotype was revealed. The findings can be used for quantitative estimates of the genetic danger from radiation for humans. The authors are grateful to V.S. Lysenkova, G.A. Vilkina, K.N. Yarovoy, and A.I. Shaks for assistance. Figures 4; tables 4; references 7.

Allozyme Loci Mutagenesis of Induced by Ionizing Radiation in *Pinus Sylvestris L.* Megaspores Due to Chernobyl Nuclear Power Plant Accident

947C0068D Moscow GENETIKA in Russian Vol. 29 No. 2, Feb 93 pp 266-273

[Article by V.A. Kalchenko, N.P. Arkhipov, I.S. Fedotov, General Genetics Institute imeni N.I. Vavilov at Russia's Academy of Sciences, Moscow, and Pripyat Scientific Production Association, Chernobyl; UDC 575:582.475.4]

[Abstract] The pressure exerted by man-caused environmental factors on natural ecosystems and the urgency of correlating the changes in the radiation conditions in the environment and the growth of the mutation burden in populations with their adaptation capabilities prompted a reexamination of the electrophoretic analysis of pine seed proteins *Pinus sylvestris L.* exposed to irradiation after the Chernobyl nuclear power plant accident in order to assess the genetic impact of the Chernobyl accident on the pine forest, set up radiation-environmental monitoring in the population relocation area's reforestation plantings at the molecular level, and ascertain the extent to which these data can be used to predict long-term genetic consequences on the nature's other creatures and humans. A list of enzymes with the number of their scored gene loci and commission code number, examples of abnormal heritability products of enzyme gene loci revealed by the electrophoresis study, the frequencies of various types of enzyme gene loci mutations induced by ionizing radiation in *Pinus sylvestris L.* macrospores after the accident, the genetic efficiency of radiation in the relocation area based on *Pinus sylvestris L.* data, and the rate of loci mutation which are encoding the enzyme synthesis in *Pinus sylvestris L.* endosperms in the relocation area are summarized, and the dependence of the viable seed yield and various types of mutations on the dosage rate is plotted. The findings confirm that the pine is a convenient test system which makes it possible to take into account the mutations induced at the hametic level, thus making a certain contribution to developing forecasts of long-term genetic consequences as they apply to other species where observation of mutations is complicated due to biological or ethical considerations. The authors are grateful to the Corresponding Member of the Academy Yu.P. Altukhov for valuable remarks. Figures 2; tables 4; references 21: 15 Russian, 6 Western.

Use of Cosmid Bank of *Rhizobium Meliloti* Genes for Cloning Leucine Biosynthesis Gene Involved in Regulating Development of Nitrogen-Fixing Symbiosis With Alfalfa

947C0068B Moscow GENETIKA in Russian Vol. 29 No. 2, Feb 93 pp 235-245

[Article by A.A. Aronshtam, B.R. Umarov, V.N. Yerko, Ye.Ye. Andronov, B.V. Simarov, Agricultural Microbiology Institute, St. Petersburg; UDC 575:576.851.155]

[Abstract] The unique ability of glomal bacteria (*Rhizobia*) to bind atmospheric nitrogen in symbiosis with bean plants prompted an attempt to demonstrate the role *Rhizobium meliloti* leucine biosynthesis genes in the development of nitrogen-fixing symbiosis with alfalfa. To this end, the strains HB101 and S17.1 of *Escherichia coli* and the CXM 1 strain of *Rhizobium meliloti* as well as the pRK2013, pSUP2021, and pLAFR5 plasmids are used in the experiment. A leucine-auxotrophic mutant strain CXM1 which has lost its ability to form nitrogen-fixing symbiosis with alfalfa is produced by nonspecific transposonic mutagenesis using the pSUP2021 plasmid (Tn5) as the donor. The study shows that the addition of leucine directly to the plants inoculated with the auxotrophic mutant does not restore its ability to develop normal symbiosis. Large-scale screening of four types of alfalfa under sterile microvegetation conditions reveals the absence of interstrain variability and the existence of individual variability based on the behavior of host plant response to leucine auxotrophic inoculation. A bank of CXM1 strains is constructed on the basis of the cosmid pLAFR5 vector and used in conjugation cross-breeding for the purpose of complementing leucine auxotrophe. The findings also indicate that the leucine biosynthesis genes are involved in regulating the development of nitrogen-fixing symbiosis with alfalfa. The results lay the groundwork for a more detailed study of the relationship between the leucine biosynthesis and the expression of symbiotic properties in these bacteria. The authors are grateful to T.V. Ivashina and N.A. Provorov for assisting with the gene bank and making valuable remarks. Figures 5; tables 2; references 21: 3 Russian, 18 Western.

REC41: New Gene Involved in Regulating Recombination in *Saccharomyces Cerevisiae* Yeast

947C0068C Moscow GENETIKA in Russian Vol. 29 No. 2, Feb 93 pp 246-256

[Article by O.V. Chepurnaya, T.N. Kozhina, V.T. Peshekhonov, V.G. Korolev, St. Petersburg Nuclear Physics Institute imeni B.P. Konstantinov at Russia's Academy of Sciences, Gatchina; UDC 575:582.282]

[Abstract] The system for selecting rec⁻ yeast mutants based on taking into account the interplasmid recombination proposed earlier by the authors is examined further, and the findings of a study of one mutant which was produced with the help of this system and is characterized by a decreased interplasmid recombination frequency are presented. The rec41 mutant under study was produced from the 2D-3031 haploid strain. The study indicates that rec41-1 mutation lowers the efficiency of double-strand DNA break repairs due to the interplasmid and, possibly, interchromosomal and interchromatide recombination, leading to an elevated sensitivity of the mutant cells to ionizing radiation. An incomplete block of repair and recombination processes in rec41 mutant cells is probably due to the rec41-1 mutation phenotype. The REC41 gene was cloned in the pL3 multicopy vector. Integration mapping shows that the REC41 gene is located on the left arm of the VII chromosome, very close to the LYS5 gene. Plans for sequencing this gene and further investigating its genetic properties are outlined. Figures 2; tables 4; references 24: 6 Russian, 18 Western.

Biomonitoring of Chemicals in the Environment

947C0042A Moscow MEDITSINSKAYA GAZETA in Russian 27 Aug 93 p 10

[Interview by MEDITSINSKAYA GAZETA correspondent Yelina Tokarenko with Vyacheslav Valentinovich Lyakhovich, professor and corresponding member, Russian Academy of Medical Sciences, and head of the Molecular Pathology and Ecological Biochemistry Institute, Siberian Department, Russian Academy of Medical Sciences under the "New in Science" rubric: "Barrier to Xenobiotics"]

[Text] [Boxed item: Novosibirsk scientists are proposing new methods of protection against chemical aggression.]

Do you know how many chemicals surround us in our everyday life or that are used in industry and agriculture? More than 80,000. And according to forecasts, in less than a decade this figure will double or triple. Many of them manifest mutagenic, carcinogenic, and teratogenic properties fully justifying the name xenobiotic (from the Greek word meaning "foreign to life"). And by the way, they include not only the notorious pesticides but also the inks, copy machine paper, and printer's ink without which this article could not have come to light. Comparatively complete ecological and toxicology tests have only been conducted on several chemicals of natural and anthropogenic origin, however. It is virtually impossible to keep pace with all of the new modifications. That is why knowledge about the mechanisms and laws of biotransformation of xenobiotics in the body must be systematized to at least some extent and why the processes must be studied at the molecular level. This is the key to the problem of chemical aggression overall and to the search for a suitable "antidote." The Molecular Pathology and Ecological Biochemistry Institute of the Siberian Department of the Russian Academy of Medical Sciences has research priority in this field. It was born (it was established only 2 years ago) out of the social demand of the region, which had become the hostage of technocratic thinking and thoughtless "subjugation of nature." Basic research on the biotransformation of xenobiotics under the direction of V. Lyakhovich, professor, corresponding member of the Russian Academy of Medical Sciences, and head of the institute, has already been going on for 20 years. This research has made it possible to substantiate and develop advanced methods of diagnosing, treating, and preventing ecologically induced diseases and to monitor health at the individual and population levels. V. Lyakhovich responds to the questions of our MEDITSINSKAYA GAZETA correspondent.

[Tokarenko] Vyacheslav Valentinovich, you are essentially contemplating a new, higher level of assessing the medical consequences of environmental pollution and predicting disease based on modern molecular biology methods?

[Lyakhovich] Unfortunately, medical ecology has been pretty much restrained in a verification stage, and even the scientific literature is essentially devoted to describing toxic effects while their role in measuring functional as well as biochemical parameters is either assumed with caution or else not assumed at all. By the way, it is precisely these indicators that are the most adequate criteria of the potentially hazardous effect of environmental pollution on man and animals. They make it possible to determine the level of xenobiotics' penetration into the body and their biologically active doses, and they make it possible to judge reactions that are now occurring and to reliably predict the risk of disease. An increasing number of scientists are even classifying drug therapy as a "pharmacologic press" that, together with chemical factors in the environment, may affect human ecology as a whole.

[Tokarenko] And what has become the main focus of attention?

[Lyakhovich] The body contains enzyme systems effecting the biotransformation of foreign compounds localized in the cells of the liver, kidneys, and lungs. These enzymes catalyze a number of oxidation-reduction reactions and conjugation reactions. There are rather many of them. Without going into very specific details, I will only say that various biotransformation routes may, under the effect of external factors, also result in detoxication of a xenobiotic or else may, on the

other hand, be accompanied by the formation of even more toxic components. Specifically, knowledge of these fine points makes it possible to conduct biomonitoring of the chemical effect of the environment by evaluating xenobiotic metabolism systems.

[Tokarenko] And how is this done?

[Lyakhovich] We focused our attention on proteins (cytochrome P-450) capable of transforming polycyclic aromatic hydrocarbons (and also dioxins, biphenyls, etc.) into products carrying the threat of cancers and all possible abnormalities. These proteins only begin to "work" when the body comes into contact with chemical factors of the environment. And so as it turned out, many dozens and even hundreds of compounds cause the same response in the body—expression of genes of the cytochrome P-450 family. This means that it is possible to get by without laborious (and yes expensive) routine studies analyzing each of the components of technogenic poisoning.

These works have been postulated as the basis of a system of methods for the biomonitoring of chemical pollution. Experimental animals act as a "barometer." The method was successfully tested in Altay, in the Kuzbas, and in the Novosibirsk and several other oblasts that are in an adverse ecological situation. In addition to everything else, the method makes it possible to estimate the total effect of pollution on the body, which is still difficult to do by other methods, and to determine clear-cut criteria for formulating groups at risk of specific diseases just as was done at the Azot and Soda enterprises and at the titanium-magnesium combine in the Perm Oblast.

[Tokarenko] A prediction is a prediction, but what about treatment?..

[Lyakhovich] A hybridoma process for obtaining monoclonal antibodies to specific isoforms of cytochrome P-450 has been developed at our institute. A bank of monoclonal antibodies suitable for suppressing the activity of these enzymes has been developed.

[Tokarenko] Is it thought that your research should provide a clear-cut picture of the effect of "chemistry" on offspring?

[Lyakhovich] One block of work is simultaneously related just to the transplacental transport of chemical compounds from mother to fetus. Specific recommendations apply to both pregnant women who come into contact with chemical compounds and to their offspring. We put them into special risk groups. The most insidious are organochlorine pesticides (such as DDT). They are lipidophilic. They accumulate in adipose tissues, reach significant toxic concentrations, and then poison the fetus by penetrating through the placenta and cause stillbirth.

[Tokarenko] In what other areas can you interest clinical medicine?

[Lyakhovich] There is yet another example where the results of basic works are used in practice. A cycle of research studies was conducted in Mirnyy, Nobosibirsk, and Novokuznetsk. It was related to what is termed metabolic status as determined by test drugs. This means the dynamics of liver function. Depending on the activity of their metabolic processes, individuals are classified as "fast" or "slow" metabolizers. Along with this comes different predisposition to selected diseases.

The first group includes individuals who are especially susceptible to harmful habits and to the effect of negative factors associated with industry. They accounted for about 8 percent of the workers from toxic industries whom we studied, and they are at high risk of colorectal cancer and breast cancer. Persons with slow metabolization—approximately 4 percent of those studied—have a tendency toward bladder and throat cancer. As complications of drug therapy, they may possibly develop allergies and systemic lupus erythematosus. It is significant that every "ultraslow" metabolizer suffers from intolerance of some drug or foodstuff.

[Tokarenko] And with what is this type of gradation linked?

[Lyakhovich] The phenomenon of "fast" and "slow" metabolizers has been explained at the level of the gene apparatus. It has become clear that the bodies of persons who are "slow" metabolizers contain 100 to 200 times fewer enzymes involved in oxidation of xenobiotics. The cause is a defect of specified genes. Differences in metabolic status are very significant in different ethnic groups. Oligonucleotide primer-probes synthesized at the institute can be used along with the technique of amplification to successfully detect more than 95 percent of cytochrome P-450 dB gene mutations. This will help clinicians select individual drug therapy with consideration of the metabolic status. We are already using techniques based on the method to study the populations of Altay, Siberia, and the Far North.

Nuclear Peptides Which Specifically Bind Oligonucleotides

947C0084A Moscow MOLEKULYARNAYA BIOLOGIYA in Russian Vol. 27 No. 2, Mar-Apr 93 pp 305-308

[Article by F.P. Svinarchuk, Ya.V. Lavrovskiy, D.A. Konevets, V.V. Vlasov, Novosibirsk Bioorganic Chemistry Institute at the Siberian Department of Russia's Academy of Sciences; UDC 577.112.855]

[Abstract] The possibility of selective suppression of the gene expression with the help of short oligonucleotides which are complementary to target mRNA (antisense oligonucleotides) and a lack of complete understanding of the mechanism of cell penetration by oligonucleotides and their interaction with the cell biopolymers prompted an attempt to identify the proteins which bind oligonucleotides in the cell nucleus. To this end, reaction-capable oligonucleotide derivatives with the same cell

penetration parameters as the original oligonucleotides were used; these oligonucleotides with different compositions (1.GTGACGTCAG, 2.T(p)T_{15}, and 3.T$(AC)_6$) were synthesized by the phosphotriester method. The experimental procedure is outlined. The use of oligonucleotides carrying reaction-capable radicals of aromatic 1-chlorethylamine in 5'-terminal phosphates which covalent-attach the oligonucleotide derivatives to the cell's biopolymers made it possible to detect peptides with a molecular mass of 1.5, 3.0, and 6.0 kDa specifically interacting with the nucleic part of the derivatives in nuclear extracts of mice and human mammalian cells. Similar proteins with a 1,5 and 3.0 kDa molecular mass were also detected in insect, plant, yeast, and bacteria cells. It is speculated that oligonucleotides penetrate the cell by pinocytosis, possibly through mediation by specific receptors, yet their subsequent fate, including the appearance in the nucleus, remains unclear. A study of the effect of oligonucleotides with varying length, plasmid DNA, and tRNA from yeast and poly-(A)RNA shows that the proteins modified by alkylating oligonucleotide derivatives are not specific to the origin of nucleic acids. The proliferation of the above proteins with a 1.5 and 3.0 kDa mass (isolated from cell nuclei of *Blatella germanica* cockroach, *Begonia sp.* plants, *Sacharomices cerevisiae* yeast, and extract of *Escherichia coli* cells) attests to their participation in important cell activity processes. Figures 4; references 9: 5 Russian, 4 Western.

In Vitro Translation Suppression of Tick-Borne Encephalitis Virus Using Antisense Nucleotides

947C0084B Moscow MOLEKULYARNAYA BIOLOGIYA in Russian Vol. 27 No. 2, Mar-Apr 93 pp 327-334

[Article by N.Yu. Nokomonova, V.V. Gorn, V.V. Vlasov, Therapy Institute at the Siberian Department of Russia's Academy of Sciences and Bioorganic Chemistry Institute at the Siberian Department of Russia's Academy of Sciences, Novosibirsk; UDC 577.217.3/113.4]

[Abstract] Successful applications of antisense oligonucleotides and their derivatives for specifically inhibiting the gene expression in various eucaryotic systems prompted a research effort aimed at identifying segments of the tick-borne encephalitis virus RNA sequence which are most sensitive to the effect of oligonucleotides in order to develop effective virus reproduction. To this end, mRNA-E', mRNA-N3S, mRNA-2BNS3, and mRNA-NS34A4B' which encode the tick-borne encephalitis virus (VKE) proteins were used while genetically engineered analogues of tick-borne encephalitis virus proteins were obtained from the Bioorganic Chemistry Institute at the Siberian Department of Russia's Academy of Sciences in Novosibirsk. The experimental procedure is outlined. To select RNA segments most accessible to oligonucleotide binding and to compare the oligonucleotide efficiency, the matrix structure was assessed using the computational methods described by Solovyev and Kel. The study reveals that an oligonucleotide complementary to such a protein segment at a 2.5 μM concentration suppresses biosynthesis of the full-scale protein almost completely and leads to generation of a shorter product. The *in vitro* study demonstrates that the most effective inhibition is probably due to the fact that the 40S ribosome subunit cannot destroy stable duplexes in the 5'-nontranslated mRNA area, as a result of which the translation initiation is disrupted. The findings open up the possibility of developing derivatives for suppressing the tick-borne encephalitis virus reproduction in mammal cells. The authors are grateful to K.V. Pugachev and V.V. Solovyev for providing plasmids and helping with secondary RNA structure analyses. Figures 8; tables 1; references 15: 4 Russian, 11 Western.

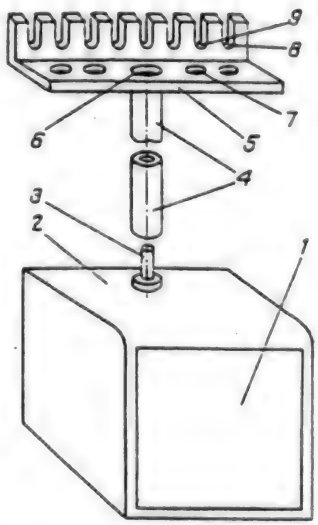
EPIDEMIOLOGY, MICROBIOLOGY,AND VIROLOGY

Air Sampler

937C0369B Moscow GIGIYENA I SANITARIYA in Russian No. 1, Jan 93, p 75

[Article by G. M. Basova, Voronezh Oblast Epidemiological Station]

[Text] Air sampling requires laboratory technicians to spend a long time in an atmosphere of toxic substances and to endure a significant physical load. This device is intended to hold absorbers and filter holders. It can be used by an operator to take samples while he is located outside the atmosphere of toxic substances. There is a pin 3 threaded into a hole in cover 2 of an electric-powered aspirator 1 (see figure). A rod 4 made from Duralumin tubing with an inside diameter equal to the diameter of the pin is mounted on the pin. The length of the tubes is varied in height from 60 to 80 cm depending on the air sampling requirements. A comb 5 made from an angle (50x50x250 mm) is mounted on the free end of the rod. It is secured to



Device for holding absorbers and filter holders. Explanation in text.

the rod by means of a threaded connection 6, for which purpose the corresponding hole is drilled into the horizontal part of the comb. There are holes 7 with a diameter of 20-30 mm in the horizontal part of the comb for the absorption instruments, and slots 8 and 9 of different widths in the vertical part to hold the corresponding types of adapters.

The device can be used to sample air at heights of 160-170 and 95-100 cm—that is, when working in standing and seated position. The device has enjoyed wide use in public health and chemical laboratories of Voronezh Oblast.

Protective Effectiveness of Microbiological Boxes

937C0369A Moscow GIGIYENA I SANITARIYA in Russian, No. 1, Jan 93 pp 36-40

[Article by L. S. Dzhindoyan, M. Yu. Tarasov and A. V. Shipin, Scientific Research Institute of Microbiology, Main Command of the CIS United Armed Forces, Kirov]

[Text] Boxing systems, so-called micrological safety or protective boxes, are usually used to protect personnel in microbiological and virological laboratories working with and conducting research on infectious materials. Foreign and domestic experience accumulated to this day allows us to differentiate boxing systems into different classes depending on their structure, which is determined in turn by the danger of the infectious material to man and by the nature of the research operations and processes.

These principles determine division of bioprotection boxes into structures which keep the infectious material within the volume of the corresponding systems partially (class 1 and 2 boxes) or completely (class 3 boxes).

A modern approach to designing and correctly using boxing systems would be impossible without developing scientifically substantiated criteria of their protective effectiveness which would ensure the required protection for personnel. In turn, the necessary protection for personnel must be based on strictly grounded infection risk criteria derived from the degree of danger of the infectious materials under investigation and of the corresponding laboratory operations to which they are subjected.

Various criteria are used today to describe the protective effectiveness of boxing systems depending on their type. For class 1 and 2 boxing systems the protection factor is such a criterion, while for class 3 boxing systems it is the degree to which pressure falls over a certain time in an airtightness test. In addition, as was noted above, the risk of infection to working personnel in the course of their research, which is a probability characteristic, is the regulated parameter determining the specific choice of boxing system. The importance of developing scientific methodological approaches in this area and substantiating, on their basis, optimum requirements on the structure of boxing systems depending on the degree of danger of research with infectious material carried out within them is completely obvious, and it is the main goal of this paper.

Let us examine a typical situation associated with operating a boxing system in correspondence with the objective posed above. Let us assume that a researcher must perform certain manipulations with infectious materials during his work using a boxing system. We know that an aerosol containing infectious material is formed as a result of various research operations, and that this aerosol may enter the laboratory's air environment with circulating air. In order to reduce the concentration of infectious material in aerosol form in the boxing system and prevent its escape into the room, both the boxing system and the laboratory are ventilated. The natural processes by which the concentration of infectious material decreases—owing to sedimentation and inactivation in response to various factors—should be kept in mind in this case. Possible infection of laboratory personnel is a stochastic—that is, probablistic—process. If we assume that particles of infectious material in the air environment of a laboratory follow a Poisson distribution, then the probability of uptake of a certain quantity (k) of particles by working personnel will be determined by the expression:

$$P = \frac{\left(\frac{C_n Q\tau}{Д}\right)^k}{k!} e^{-\frac{C_n Q\tau}{Д}}$$

where P—probability; $C_п$—concentration of infectious material in the room, number of cells per 1 m^3 (cells.m^{-3}); Q—pulmonary ventilation volume, $m^3.sec^{-1}$; П—infecting dose, cells; τ—time, sec.

An expression for the probability of uptake of at least one particle of infectious material by working personnel may be obtained from equation (1):

$$P = 1 - e^{\frac{C_n Q_\tau}{Д}}$$

Naturally equation (2) will be valid for the case when no devices are used in the course of the research to protect the personnel (that is, the work is done without a boxing system). When a boxing system is used in research as a primary barrier, the probability of infection of working personnel will be significantly lower. Equation (2) would have to be modified for this case. This is associated primarily with the fact that a boxing system is a technical device, failure of which reduces its protective effectiveness during the failure interval. A term accounting for the probability of infection of personnel in the event of the boxing system's failure must be introduced into equation (2) in this connection. We can arrive at a general equation for the probability of infection of working personnel in this way:

$$P = (1 - e^{-\lambda\tau}) e^{-\lambda_0 t} + (1 - e^{-\lambda_0 \tau})(1 - e^{-\lambda_0 t})$$

where λ—intensity of infection of personnel when the boxing system works without failure, sec^{-1},

$$\left(\lambda = \frac{C_n Q}{Д}\right);$$

λ_O—intensity of infection of personnel in the event of the boxing system's failure, sec^{-1},

$$\left(\lambda_0 = \frac{C_{n0} Q}{Д}\right);$$

λ—intensity of the boxing sytsem's failure, sec; $C_П$—concentration of the infectious material in the room prior to the boxing system's failure, $cells.m^{-3}$; $C_{По}$—concentration of infectious material in the room created as a result of the boxing system's failure, $cells.m^{-3}$; t—time of boxing system's failure, sec; τ—current time of work of the boxing system, sec.

Equation (3) is inconvenient for analysis in the form shown here, which is why it is suitable to simplify it. Because variables $\lambda\tau$, $\lambda_\sigma\tau$ $\lambda_O\tau$ are less than unity, expanding the exponents into a series and limiting ourselves to just linear terms, we can arrive at a transformed expression for the probability of infection of personnel working with infectious material in a boxing system:

$$P = \lambda\tau(1 - \lambda_\sigma\tau) + \lambda_\sigma\tau\lambda_0 t.$$

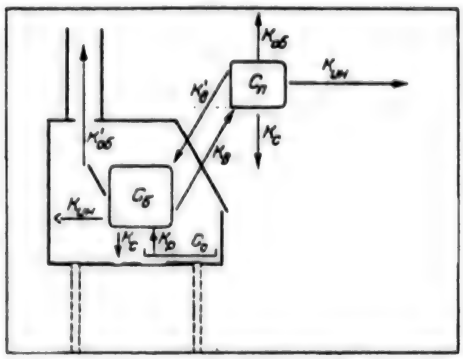
In the case where the permissible probability (risk) of infection of working personnel is known, equation (4) may be used to calculate infection intensity. The authors of [2] proposed a value of permissible infection risk equal to 1.10^{-5} per person (over the course of a year) on the basis of an analysis of the frequency of cases of infection in different laboratories and the risk of death of people (accidents) owing to various random natural and social factors. Basing ourselves on this value of infection risk, we can calculate the permissible intensity of infection ($\lambda_П$), which is 1.10^{-8} hr^{-1} (on the condition that on the average, personnel are in contact with infectious material on the order of 1,000 hours per year). The resulting infection risk value agrees with published data [7]. Thus, performing the corresponding substitutions and transformations, we can arrive at the following equation for the intensity of infection of working personnel:

$$\lambda = \frac{1 \cdot 10^{-8} - \lambda_\sigma \lambda_0 t}{1 - \lambda_\sigma \tau}.$$

Let us analyze this equation. In the case of trouble-free operation of the boxing system, the intensity of its failure λ_σ is equal to zero, from which it follows that $\lambda = \lambda_П = 1.10^{-8} hr^{-1}$—that is, that the intensity of infection of working personnel when the boxing system operates trouble-free is equal to the permissible infection intensity. However, the intensity of failure of the boxing system is always greater than zero, and therefore the protective effectiveness of the boxing system must provide for a personnel infection intensity of less than 1.10^{-8} hr^{-1}. In the theory of the reliability of technical systems, redundancy is introduced into these systems with the purpose of reducing the failure intensity. However, if we assume that the time of operation of a back-up fan is from 10-50 sec, a back-up ventilation system would not result in a significant decrease in λ_σ During this time, a certain quantity of infectious material may be released into the laboratory room depending on the concentration of the infectious material in the boxing system and its infecting dose, which will cause infection of personnel.

The risk of infection of personnel may be reduced by decreasing the intensity of infection of personnel in the event of failure of the boxing system (λ_O)—that is, by correctly (justifiably) selecting the type of boxing system. The value of λ_O depends on the concentration and form (infecting dose) of the infectious material, and therefore the optimum type of boxing system should be selected for particular operations with certain pathogenic microorganisms. Many years of experience of microbiological research are generalized in WHO recommendations to permit selection of the type of boxing system on the basis of information on the operations being conducted and the form of the investigated microorganism [3]. However, the boxing system characteristics presented in these recommendations are descriptive (for example, airtight boxing systems, boxing systems with laminar flow, etc.), and they do not contain quantitative characteristics necessary for substantiated design and operation of different classes of boxing systems. Equation (5) obtained above may be used to substantiate the principal technical requirements on particular types of boxing systems.

Let us assume as before that a researcher is performing various manipulations with infectious material in a boxing system, as a result of which infectious material spreads in aerosol form, including out into the laboratory room. The processes occurring here may be diagrammed, and they may be described by the following system of differential equations:



Spread of Infectious Material Out of a Boxing System:

C_Q, C_σ, C_Π—initial concentration of infectious material, and the concentration formed in the boxing system and room; k_p—process of formation of aerosol out of the infectious material at a rate k_p; k_c—process of sedimentation of infectious material at a rate k_c; k_{NH}—process of inactivation of infectious material at a rate k_{NH}; $k'_{o\sigma}$, $k_{o\sigma}$—process of removal of infectious material by means of the ventilation system of the boxing system and the room at a rate $k'_{o\sigma}k_{o\sigma}$; k'_B. k_B—process of movement of infectious material out of the room and out of the boxing system.

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where k_p—atomization factor, sec^{-1}; C—concentration of the investigated sample, $cells.m^{-3}$; $k'_{o\sigma}$, $k_{o\sigma}$—air exchange factor for the boxing system's ventilation system and the room, sec^{-1}; k_c—sedimentation coefficient, sec^{-1}; kNH—inactivation coefficient, sec^{-1}; K_B—constant characterizing release of infectious material out of the box into the room, sec^{-1}; k_B;—constant characterizing transfer of infectious material from the room to the box, sec^{-1}; C_σ, C_Π—current concentrations of infectious material in the boxing system and in the room, $cells.m^{-3}$.

$$\frac{dC_\sigma}{d\tau}=k_pC-(k'_{o\sigma}+k_c+k_{ин})C_\sigma-k_BC_\sigma+k'_BC_\Pi,$$

$$\frac{dC_\Pi}{d\tau}=k_BC_\sigma-k'_BC_\Pi-(k_{o\sigma}+k_c+k_{ин})C_\Pi.$$

This equation system may be solved in general form by numerical methods; however, we are practically interested in the stationary case, in which all processes are in equilibrium and $dC_\sigma/d\rho=dC_\Pi/d\tau=0$. Equating equation (6) to zero and performing a number of manipulations, we can obtain an expression for the steady-state concentrations of infectious material in the boxing system and in the room:

$$C_\sigma=\frac{k_pC(k_{o\sigma}+k_c+k_{ин}+k'_B)}{(k'_{o\sigma}+k_c+k_{ин}+k_B)(k_{o\sigma}+k_c+k_{ин}+k'_B)-k_Bk'_B},$$

$$C_\Pi=\frac{k_BC_\sigma}{k_{o\sigma}+k_c+k_{ин}+k'_B}$$

We know that the protective effectiveness of class 1 and 2 boxing systems is characterized by the protection factor k_3, which is determined experimentally as the ratio of the concentration of aerosol simulating infectious material in the boxing system to its concentration in the room [5]. The protection factor is not used with a class 3 boxing system because the sensitivity of methods for recording simulated aerosols is below the real protective effectiveness of a class 3 boxing system. However, the obtained equation (7a) allows us to calculate the protection factor for any class of boxing system:

$$k_3=\frac{C_\sigma}{C_\Pi}=\frac{k_{o\sigma}+k_c+k_{ин}+k'_B}{k_B}$$

It should be noted that two parameters are used in the calculations in equation (8) (k_B and k'_B, which cannot be determined directly by experimental means. Both of these parameters may be calculated on the basis of the laws of aerodynamics. However, the formulas for the above parameters will differ in application to different classes of boxing systems due to the structural features of each class of boxing system.

Thus, class 1 and 2 boxing systems are exhaust systems with open access from the front panel. As a rule the protective effectiveness of such boxing systems is the product of the laminar nature of air flow in the opening in the boxing system provided for the operator, and restriction of the operator's access into the boxing system by reduction of the area of the opening. In this case transport of aerosol from the boxing system into the room is associated with turbulization of the air flow in the boundary layers of the opening, and with manipulations carried out with the operator's hands. A class 3 boxing system is an airtight one in which access into its interior is achieved with hermetically attached gloves. In this case transport of infectious aerosol into the room would be possible due to its diffusion through existing leaks.

It should be noted that different types of boxing systems, including similar class 1, 2 and 3 boxing systems intended for microbiological research, are widely used

today in research on toxic and radioactive substances. Theory permitting us to calculate protective effectiveness when working with these substances has been developed sufficiently well on the basis of the laws of aerodynamics for such boxing systems. Because calculation of parameters k_B and k'_B (coefficients characterizing transport of aerosol from the boxing system into the room and its return back into the boxing system) does not require knowledge of numerical characteristics inherent to microbiological aerosols, the formulas used to calculate them will also be valid for boxing systems intended for work with infectious material. The following formulas are presented in [4] for calculating coefficients k_B and k'_B:

for class 1 and 2 boxing systems:

$$k_в = \frac{fA^2}{v_м a^2},$$

$$k'_в = \frac{v_м f}{V_о},$$

for class 3 boxing systems:

$$k_в = \frac{fD^2}{v_м a^2},$$

$$k'_в = \frac{\Delta p}{p_н t_{пр}},$$

where f—cross section of the opening (or leaks) in the boxing system, m^2; v_m—rate of air flow in the opening (or leaks), $m.sec^{-1}$; a—thickness of the wall of the boxing system, m; A—coefficient of turbulent exchange, $m^2.sec^{-1}$; D—diffusion coefficient, $m^2.sec^{-1}$; V_o—volume of the boxing system, m^3〉airtightness test, $kg.m^{-2}$; p_H—absolute pressure in the room, $kg.m^{-2}$; $t_{Пр}$—duration of airtightness test on boxing system, sec.

The entire complex of equations (5) and (8) may be used with regard for formulas (9-9c) to calculate the necessary protective effectiveness of different classes of boxing systems using a principal indicator such as the protection factor.

Let us first examine class 1 and 2 boxing systems. Work not leading to formation of a large quantity of aerosol may be carried out in boxing systems of this type in accordance with WHO recommendations. In addition work with infectious material of low pathogenicity is also recommended in such protective systems. The following boundary conditions may be adopted for this case: an average concentration in the boxing system of $C_o \leq 10$ $cells.m^{-3}$ (typical of the following operations: preparing streak cultures in Petri dishes, placing a wire loop bearing inoculation material in a flame, pouring culture into test tubes, and so on [5], an infecting dose of II [G1].10^4 cells (typical of microorganisms evoking typhoid fever, cholera, anthrax and so on [5], a boxing system volume (V_o) of 1 m^3 and room volume ($V_П$) of 200 m^3 (a 6x8 m laboratory). In the event of failure of the boxing system's ventilation, it may be assumed that infectious material in aerosol form in the boxing system will spread uniformly throughout the entire room. Then the concentration of infectious material in aerosol form in the room may be calculated using the formula:

$$C_п = C_{по} = \frac{C_о V_о}{V}$$

and for the conditions presented above it will be 5.10^{-2} $cells.m^{-3}$. Substituting the obtained value of $C_П$ in equations (5) and (8), we can determine the required protection factor of class 1 and 2 boxing systems. It will be found to be equal to $1.2.10^5$. What this value means physically is that when an aerosol concentration of, for example, on the order of 1.10^5 $cells.m^{-3}$ is created in class 1 and 2 boxing systems, the concentration of aerosol in the room will not exceed 1 $cell.m^{-3}$. Next, using equation (9a), we can determine the rate of air flow that must be maintained in the opening of the boxing system in order to ensure the boxing system's required protection factor of $1.2.10^5$. It will be equal to 0.7 $m.sec^{-1}$. The air flow rate obtained here by calculation confirms the numerous recommendations for this value contained in the literature [2,5]. Analysis of information in Soviet and foreign literature [6,8] shows that as a rule, class 1 and 2 boxing systems that have presently been developed in different countries satisfy the requirements presented above, and consequently provide protection to personnel.

Let us examine class 3 boxing systems. Boxing systems of this type are intended for any laboratory operations with any pathogenic microorganisms. In this case we can assume the following boundary conditions: average concentration in the box (C_o) on the order of 1.10^3 $cells.m^{-3}$ (the indicated concentration may arise in the following operations: centrifugation, vibration of a wire loop in the course of inoculation, and intranasal administration of infectious material to mice [5]) and an infecting dose (II) of one cell (typical for example of Marburg and Lassa viruses as well as of bacterial infections such as plague, tularemia and so on [5]). Substituting the adopted values into equations (5), (8) and (9a), we can come to the conclusion that a properly working class 3 boxing system provided guaranteed protection to personnel. In the event of failure of the ventilation system of a class 3 boxing system (the probability of failure λ is equal to 1.10^{-4} hr^{-1} [1]), an excess pressure in relation to the room may be created within it for a short time. The concentration of infectious material in the room created as a result of failure will depend wholly on the airtightness of the system, and it may be calculated by the equation:

$$C_{по} = k'_в C_о t.$$

It was noted above that the intensity of infection of personnel in the case of trouble-free operation of a class 3 boxing system is practically equal to zero. In this case an expression may be obtained from equations (5) and (10) by which to calculate the required airtightness of a class 3 boxing system:

$$k'_{\text{в}} = \frac{1.44}{C_0}.$$

Substituting the concentration of infectious material that could be created in a class 3 boxing system into formula (11), we can obtain the required leakage factor for the boxing system (for example, at an average concentration of 1.10^3 cells.m^{-3} the leakage factor is $1.44.10^{-3}$ hr^{-1}). Boxing systems intended for work with radioactive materials are often used today for work with infectious materials. According to the All-Union State Standard* they are "airtight" if the pressure drop accompanying an excess air pressure of not less than 1,000 Pa (100 $kg.m^{-2}$) does not exceed 10 percent over a time interval of not less than 30 minutes. Substituting the indicated data into equation (9a), we can determine the leakage factor for both boxes, which is $1.9.10^{-3}$ hr^{-1}. We can also use equation (11) to calculate the permissible average concentration of infectious material in this type of boxing system, which will be $0.7.10^3$ cells.m^{-3}—that is, for practical purposes the necessary protection is afforded to personnel by a boxing system of this type.

Thus a scientific methodological approach is presented here making it possible to substantiate the principal technical requirements on boxing systems in relation to different conditions of their use. The main thing is that design and operation of boxing systems must be directly interrelated with the actual conditions of their work, inasmuch as characteristics such as the system's reliability, the possible concentrations of infectious material in the aerosol formed when performing various research operations, the degree of danger of the material in question, and the permissible risk to personnel carrying out particular types of research must be accounted for.

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In Vivo and *in Vitro* Study of Plasmid Fragments of Ca^{2+}-Dependence of *Yersinia Pestis* (Lehmann, Neumann)

947C0068A Moscow GENETIKA in Russian Vol. 29 No. 2, Feb 93 pp 225-234

[Article by O.T. Mozharov, Ye.P. Savostina, P.I. Anisimov, G.P. Shvedun, I.N. Yezhov, I.V. Tuchkov, T.I. Shiryayeva, All-Russian Mikrob Antiplague Scientific Research Institute, Saratov; UDC 576.8:575:616.981.452]

[Abstract] The discovery that the Ca^{2+}-dependence plasmid is the necessary inversion genome element for imparting virulence prompted a study in which biologically active pCaD loci were cloned and their functions subsequently examined. In particular, the fifth HindIII fragment of PCaD and hybrid plasmids containing small functionally significant segments of this fragment are investigated. Altogether, a bank of HindIII, EcoRI, and PstI fragments of the Ca^{2+}-dependence plasmid of *Yersinia pestis*, strain 358, is constructed, and restriction pCaD charts are plotted by means of restriction analysis using these fragments as probes. The findings demonstrate that the study of the mutation versions' expression of an intact pCaD plasmid or even its small fragments is probably not justified in some cases due to the complicated and little-known regulatory relationships among this plasmid's individual genes. An animal study also reveals that two subfragments of the fifth HindIII fragment are capable of ensuring the pathogenic and invasiveness properties of avirulent strains of *Y. pestis, Y. pseudotuberculosis*, and *E. coli* while the full nucleotide sequence does not exhibit such properties. The issue of the reasons for the absence of protective effect from immunization with *E. coli* strains $pSM2^+$ and $pSM3^+$ remains unclear. Figures 5; tables 2; references 36: 10 Russian, 26 Western.

Inhibitory Effect of 6-Azacytidine on Mollicutes and its Probable Mechanism

947C0057D Kiev MIKROBIOLOGICHESKIY ZHURNAL in Russian Vol. 55 No. 2, Mar-Apr 93 pp 99-104

[Article by I.G. Skripal, V.V. Babichev, S.V. Bezuglyy, O.V. Yegorov, Ye.S. Korobkova, L.P. Malinovskaya, L.P. Panchenko, I.P. Tokovenko, A.S. Shalamay, I.V. Alekseyeva, Microbiology and Virology Institute at the Ukrainian Academy of Sciences, Kiev; UDC 579.22:577.113.6]

[Abstract] It is reported that low concentrations of 6-azacytidine (6-AC)—a synthetic analog of cytidine produced at the Molecular Biology and Genetic Institute at the Ukrainian Academy of Sciences—suppresses DNA-genome virus (particularly adenovirus) reproduction and in contrast to 5-AC, is not very toxic and is not a carcinogen; moreover, it displays anticancer activity. It is also noted that there are no published data on the antimicrobial action of 6-AC but only indirect observations attesting to such activity. To bridge this gap, data on the effect of 6-AC on the functioning of various mollicutes and the probable molecular mechanism of this effect are investigated. In so doing, *Acholeplasma laidlawi* PG-8 mollicutes from the family of *Acholeplasmataceae* and two other species—the *Mycoplasma pneumoniae* FH and *Mycoplasma fermentans* PG-18—from the family of *Mycoplasmataceae* were examined. All strains were obtained from Dr. Freundt (Denmark). The mollicutes were grown in the SM IMV-72 medium. The study demonstrates the inhibitory effect of 6-AC on mollicutes in various systematic positions; standard mollicute strains ceased growing completely in a nutrient medium at a 6-AC concentration of 125-250 μg/ml. Different levels of inhibition at other 6-AC concentrations for various strains are summarized. Translation of mollicutes on ribosomes *in vitro* ceased completely at a 100 μg/ml 6-AC concentration, attesting that there may be two targets for 6-AC in the mollicute cells and possibly other microorganisms—ribosomes and DNA-dependent DNA-polymerase. In the end, the blockage of translation and replication processes by 6-AC leads to the death of mollicutes, but since 6-AC has no mutagenic, carcinogenic, or cell differentiation-inducing effect on human cells, it may be used as an efficient means of treating respiratory (atypical pneumonia) and urogenital diseases induced by mollicutes; with respect to the role of mycoplasma in the development of AIDS, 6-AC may be used as a preventive measure, provided that proper drugs are developed and clinically tested. It is speculated that the mechanism of 6-AC effect on the mollicute growth is related to direct interference in the replication of genome DNA and blocking of the ribosome function. Figures 2; references 10: 7 Russian, 3 Western.

Treatment of Petroleum Product-Contaminated Waste Water Using Biogenic Additives

947C0057C Kiev MIKROBIOLOGICHESKIY ZHURNAL in Russian Vol. 55 No. 2, Mar-Apr 93 pp 94-98

[Article by N.I. Pavlenko, V.V. Izzheurova, I.I. Prudkaya, Bioorganic Chemistry and Petrochemistry Institute at the Ukrainian Academy of Sciences, Kiev; UDC 576.095.3:628.35]

[Abstract] The urgency of intensifying biological waste water treatment methods, particularly by adding spent and partially mineralized sludge, in order to lower capital and operating outlays and the experience of biological sewage treatment at the Lisichansk Oil Refinery (LNPZ) where partially mineralized sludge is used as a biogenic additive are discussed, and it is noted that this method may be economically efficient for many other plants. The possibility of substituting ammophos used as a biogenic additive at many plants for stimulating the development of activated sludge microorganisms in aeration tanks by partially mineralized sludge from the sludge ground at the Lisichansk Oil Refinery is investigated; in so doing, the biological additives are balanced for various nitrogen and phosphorus concentrations whereby ammonium chloride is used as the principal nitrogen source. Activated sludge was incubated for 17 days in rocking test tubes. The study demonstrates the possibility of using spent sludge as a bioadditive for enhancing biocenosis of activated sludge; addition of partially mineralized sludge balanced for the above biological elements improves the biological treatment indicators relative to petroleum product removal and raises the number of microorganisms which destroy hydrocarbons. Even partial substitution of agents with spent sludge makes it possible to save mineral raw materials and move a step closer toward developing waste-free practices of enhancing biological waste water treatment while ammophos may be substituted with ammonium chloride, thus lowering waste water contamination with phosphorus. Tables 4; references 11: 9 Russian, 2 Western.

Use of Neuston Bacilli Forms for Reservoir Treatment and Decontamination

947C0057B Kiev MIKROBIOLOGICHESKIY ZHURNAL in Russian Vol. 55 No. 2, Mar-Apr 93 pp 88-93

[Article by Ye.V. Stabnikova, V.N. Ivanov, N.N. Gregirchak, A.N. Dulgerov, Food Industry Engineering Institute and Microbiology and Virology Institute at the Ukrainian Academy of Sciences, Kiev; UDC 612.3:576.8]

[Abstract] The mechanism of bacterial neuston development on the air and water interface of reservoirs and the surface-active and hydrophobic layer on the water surface (10-100 μm) is discussed, and it is noted that today, there are virtually no bacterial preparations which enhance the self-treatment process on the basis of neuston forms of microorganisms. An attempt is made to produce such preparations based on adaptive selection of neuston bacterial forms with an elevated cell surface hydrophobia and to examine the efficacy of using neuston forms of bacterial preparations for treating water by removing petroleum hydrocar' ons and for biological decontaminating of waste water already treated by traditional methods. To this end, *Bacillus megaterium* 1BD, *Pseudomonas putida* BS-2, and *Alcaligenes paradoxus* BS-1 from the microorganism collection of the biosynthesis technology division of the Microbiology and Virology Institute at the Ukrainian Academy of Sciences grown in test tubes in a rocker making 240 strokes per minute were used. The possibility of selecting neuston bacterial forms which concentrate on the water/atmosphere interface is demonstrated; the preparation on the basis of *Bacillus megaterium* is more effective in treating petroleum-based hydrocarbon contamination than the preparation on the basis of the plankton form of the same culture. The preparation developed on the basis of the neuston form of aerobic spore-forming bacteria is more effective in biological decontamination of waste water treated by traditional methods. The preparation was tested under full-scale conditions by treating a reservoir in the Sula river flood plain. The experiment shows that water treatment with the biological preparation for 48 h reduces the total microbial dissemination and makes it possible to get rid of staphylococci and Shigella. Thus, neuston forms of bacteria with antagonistic properties with respect to pathogenic microflora may probably be used for waste water decontamination and for improving the hygienic reservoir conditions. The use of neuston forms also makes it possible to enhance the microbiological processes in a 15-40 μm surface layer. Figures 3; tables 3; references 14: 10 Russian, 4 Western.

Cell Immune Response Inhibition by *Pseudomonas Aeruginosa* Extracts

947C0057A Kiev MIKROBIOLOGICHESKIY ZHURNAL in Russian Vol. 55 No. 2, Mar-Apr 93 pp 82-87

[Article by V.A. Borisov, I.M. Furtat, V.V. Zgonnik, Ye.V. Borisova, A.A. Lolo, Yu.Yu. Shilina, Kiev State University; UDC 579.841.11]

[Abstract] The broad range of human diseases caused by *Pseudomonas aeruginosa* as well various plant and animal ailments induced by numerous pathogenic factors in the pseudomonads, primarily enzymes with a toxic effect, and the resulting immunodeficiency prompted a study of the immunosuppressive action of *Pseudomonas aeruginosa* extracts with respect to the cell immune response and an attempt to find the origin of the immunosuppressive factors. To this end, typical *Pseudomonas aeruginosa* strains separated from the sputum of pneumonia patients (Nos. 140 and 3,990) and strains which had been cultivated for a long time in nutrient media under lab conditions (Nos. 1,961 and U-1) were examined. In so doing, the effect of water-phenol, trichloracetic, and salt extracts of *Pseudomonas aeruginosa* on the delayed hypersensitivity of mice to the guinea pig antigen is studied. The study reveals that the salt extracts of the wild strains contain thermostable immunosuppressive factors of a lipid origin with a high mass (over 800 kD) which may be inactivated by trichloracetic acid and phenol. On the other hand, salt extracts of museum strains as well as water and phenol trichloracetic extracts produced from wild and museum bacteria strains do not display immunosuppressive activity. It is speculated that these factors may be a pseudomonad lipopolysachharide component and that the biological properties of pseudomonads are not related to impairments of the oxygen-dependent processes in macrophages. Figures 2; tables 2; references 10: 9 Russian, 1 Western.

MEDICINE AND PUBLIC HEALTH

Radioactive Container Found in Vilnius

94WE0136G Moscow TRUD in Russian , Nov 93 p 1

[Article by Ju. Tubinis, "Radioactive Container"]

[Text] A radioactive container was detected in the territory of the former Severnyy camp where first a Soviet, and later a Russian division had been headquartered for many years at the center of Vilnius. It is reported that the source is emitting 3,300 μR/h.

It is not clear how it appeared there since after the transfer the territory was carefully examined by experts. Much has been written about the harm inflicted to Lithuania by the former Soviet Army, and each case of environmental damage is carefully documented. Lithuanian experts have long suspected that radioactive substances may remain in the territory of former military units, but even in the camps which house missile divisions, nothing has been found thus far. The problem mostly amounted to soil contamination with petroleum products. Here, the military units indeed "worked hard." In some places, the soil was penetrated so deep that cleanup calls for enormous hard currency outlays. A lot of petroleum products penetrated the soil even in the territory of the Severnyy camp. This was established by environmental experts. Yet this contamination did not pose a serious problem for the future of this territory.

The municipal administration has decided to set up the largest business center in the region on this spot with offices, hotels, and banks.

I do not think that the unpleasant finding will destroy these cheerful prospects.

Identification of Zones With Varying Levels of Man-Caused Atmospheric Air Contamination Based on Data of Territory Survey From Space

947C0121A Moscow GIGIYENA I SANITARIYA in Russian No. 6, Jun 93 pp 7-10

[Article by L.P. Volkotrub, I.M. Yegorov, Cancer Research Institute at the Tomsk Scientific Center of Russia's Academy of Medical Sciences and Institute of Computer-Aided Control and Radio Engineering Systems, Tomsk; UDC 614.71/.73-07]

[Abstract] The shortcomings of the existing environmental pollution monitoring systems and the inadequacy of the data interpolation procedures whereby the contamination levels are assessed objectively only at the sampling spots prompted the development of new methodological approaches to identifying territories with different man-caused atmospheric air pollution levels on the basis of terrestrial monitoring and remote sensing data obtained from space using such revealing traits as dust and aerosol fraction discharges which accompany air pollution. The aerospace information is received from a regional center in the form of photographs taken simultaneously within three spectral bands (0.8-0.9, 0.6-0.7, and 0.5-0.6 μm) by a Kosmos satellite with a medium resolution multispectral scanner. The pictures are digitized at 256 brightness level and subsequently processed as numerical matrices. The conclusion is drawn that the optical contrast level of aerial and space video images of the territory correlates with the atmospheric contamination index (IZA) thus reflecting the man-caused air pollution and making it possible to use it as the atmospheric purity criterion. The principal advantages of the method are the reliability, data representation form, and the possibility of identifying the pollution source within the abnormal optical contrast zone as well as the convenience of assessing the pollution dynamics by comparing the pictures taken within a certain period, thus obviating systematic ground-level monitoring in order to determine the toxic substance concentration and analyze the near-surface concentration fields. Figures 4; references 8.

Organic Reservoir Water and Soil Contamination in Kramtsovskiy State Farm in Sverdlovsk Oblast

947C0121E Moscow GIGIYENA I SANITARIYA in Russian No. 6, Jun 93 pp 22-26

[Article by Ye.S. Brodskiy, N.A. Klyutev, A.A. Tumashov, G.L. Rusinov, V.B. Gurvich, E.A. Sokolnikov, V.S. Soyfer, Evolutionary Morphology and Animal Ecology Institute imeni A.N. Severtsov at Russia's Academy of Sciences, Chemistry Institute of the Bashkir Scientific Center at the Urals Department of Russia's Academy of Sciences, Ufa, and Oblast Center of State Sanitary and Epidemiological Oversight, Yekaterinburg; UDC 614.777-074:543.544]

[Abstract] The harmful consequences of the uncontrolled use of chemical plant protection agents which led to cases of agricultural worker poisoning prompted a study of soil and water samples taken at the Khramtsovskiy state farm in Beloyarsk rayon of Sverdlovsk oblast in June 1990 after several cases of poisoning were reported. Samples were taken near the area of suspected use or storage of chemicals and well as water from puddles and ponds near the fields. The samples were analyzed for the concentration of such organic pollutants as chlorophenols, polycyclical aromatic hydrocarbons (PAU), and pesticides by using a combination of gas-liquid chromatography (GZhKh) and mass spectrometry (MS). To this end, 50 g samples were mixed with 200 ml of 50% aqueous acetone and filtered, after which the residue was extracted in 100 ml of the same mixture, while the extract was reduced by evaporation. Total ion current (PIT) mass spectrograms of the water extract from a puddle near carrot and other fields and mass spectrograms with various retention times are plotted. The findings demonstrate that various toxic substances are found in the samples taken near the poisoning locations, especially near pesticide storage facilities, but in most cases, no abnormally high concentrations of residual amounts exceeding the maximum permissible concentration were detected except for one sample. The data are not sufficient for a complete statistical estimate of the total field contamination and for pinpointing the specific cause yet point toward the presence of individual localized contamination of the territory with possible harmful impacts on agricultural workers. Figures 6; references 3: 1 Russian, 2 Western.

Population Morbidity Due to Atmospheric Air Pollution in Zaporozhye

947C0121B Moscow GIGIYENA I SANITARIYA in Russian No. 6, Jun 93 pp 11-12

[Article by B.Ya. Ivanov, I.I. Tokarenko, T.Ye. Kulikova, Zaporozhye City Center of Sanitary and Epidemiological Oversight; UDC 616.1/.8-02:614.7]:313.13]

[Abstract] The findings of a study of the effect of air pollution on the population morbidity in Zaporozhye carried out between 1982 and 1990 whereby two observation zones were selected in the city pursuant to the instruction and methodological directives approved by the USSR Public Health Ministry are presented. Each zone—one "dirty" and one conditionally clean (Ordzhonikidze borough and Khorti neighborhood)—house a city weather forecast station. The former is located 2-3 km from an industrial area while the latter—at a 10 km distance. Morbidity data are classified by the frequency of aid requests and are obtained from current files maintained by treatment and preventive care facilities covering both children and adults. The findings are

backed by a sound statistical correlation and are consistent with the results produced by the laboratory of genetic research at the Republican Scientific Hygienic Center at the Ukrainian Ministry of Public Health. For children, morbidity in the dirty zone is higher than that in the clean zone by 3.51 times for blood diseases, 1.81 times for eye diseases, and 1.79 times for upper respiratory tract disorders while the combined morbidity is 1.6 times higher than in the clean zone, 1.45 times higher than in the rest of the republic, and 1.39 higher than the USSR average. Upper respiratory tract disorders have the highest incidence (75-87%). The findings served as the basis for developing and implementing the Biosfera comprehensive target-oriented program for improving the environmental conditions in Zaporozhye. References 5.

Concentration Dynamics of Petroleum Products, Phenols, and SAS in Water of Dnipro River

937C0212A Minsk VESTSI AKADEMII NAVUK BSSR. SERYYA BIYALAHICHNYKH NAVUK in Belarusian No. 6, Nov-Dec 91 p 127 (manuscript received 25 Jan 91) pp 90-94

[Article by A.N. Lyakh, Institute of Zoology, BSSR Academy of Sciences: UDC591.5+502.55: 628.39(282.247.32)]

[Text] Concentration dynamics of petroleum products, phenols and surface active substances (SAS) in the Dnipro river was investigated during several years. The determinations were carried out in the region of Orsha, Mogilev and Rechitsa townships above and below the population points. It was shown that the water content of petroleum products and phenols exceeded the maximum permissible concentration. In respect to petroleum products, the most contaminated river segment was in the vicinity of Orsha. The phenol content in water was higher downstream from Orsha and Mogilev. It was noted that during the past years the concentration of SAS in the Dnipro river water increased in the vicinity of Orsha and Mogilev. Figure 1; references 9.

Biologists Seek Funding for Trained Dolphins Research

947C0114A Moscow RABOCHAYA TRIBUNA in Russian, 13 Nov 93 pp 4

[Article by Ilona Yegiazarova "Intelligent dolphins are becoming working class" under the rubric of "Bordering on science fiction"]

[Text] "We shall not mention the last names," I was immediately warned by my interviewees, scientists from the Moscow State University, who for a long time have carried out experiments at a Black Sea naval base.

"Secrecy? ."

"No, this is not important. We are talking about a principally new effort. And in our peer group, it is not customary to stick your head out until the research findings are published in specialized publications. Yet the circumstances obligate us to make this known today. The hard reality is merciful both towards us and towards the dolphins."

Yet nevertheless, I decided to start with secrets. Especially since the subject is so exciting. The colleagues know: until recently, journalists weren't allowed anywhere near the dolphin aquariums related to the Navy in one way or another. And almost all of them had such a relationship. This engendered numerous rumors, including some about the dolphins' supernatural abilities. People use to say seriously that they were being used as live mines.

"Even today, you will not be met at the installation with outstretched arms," according to the scientists. But this can be explained by the secrecy of the installation itself and not by the experiments with dolphins." Yes, they were used by the military. But certainly not for aggressive purposes. In essence, dolphins served as "border guards"—they guarded a certain water area. urally, they do not have any supernatural abilitie their intellect is highly developed. This enabled t invasion by unwanted visitors. And notify .

I continued to press: "I also heard that dolphi were stuffed with chemical preparations, that electrodes were embedded into their brain, that dolphins were turned into obedient robots."

"Of course not," the scientists respond with a smile. "In principle, it is possible to affect the behavior of higher animals. Yet we were not interested in it. We and the dolphins are friends. And they are clever and understand everything..."

"Only that they cannot talk."

"Yes, they can, in their own way."

For many people, all dolphins "look the same," just like the Chinese look to the Europeans. Yet the experts never mistake any of their pupils for others. They also state that they are just as different as you and I. They even have their own character. Some of them are stubborn, some witty, some gay, some pensive. Sometimes they want to joke. Take, for example, beautiful Buran (see figure [not reproduced]); he likes to hide in a secluded place, and when he sees a human nearby, he will throw a jellyfish at him. And in so doing, the misbehaving dolphin tries to hit you straight in the face. His friend Ritm would sometimes play dead—lie on the swimming pool bottom and wait until the worried staff dive and look for him, then he would suddenly "come back to life" to everybody's joy.

Yet jokes do not get in the way of business. When the time comes to get to serious work, dolphins display enviable diligence. When asked the question "Where is the 10x12 wrench?" they will not start arguing like in a well-known joke, but will quickly bring the tool. And this

is how dolphins can be tremendously useful to humans. To tell the truth, this has not been fully comprehended by people.

In essence, scientists from the Moscow State University taught dolphins to find and help to lift any sunken equipment from the bottom. And people sink a lot of things: when laying pipelines and during underwater petroleum exploration, and during various types of repairs. Unfortunately, they are sinking the most valuable items and, as a rule, "without any trace." They do not even send divers: it is exceedingly difficult to find the lost items. At times, the diving station is not working, sometimes it is too deep, the water is turbid, or there is not enough time. Yet this does not pose difficulty for dolphins. This has been proven by many years of experiments in the Black Sea.

"How do you explain to the dolphins what it is exactly you are trying to find?" I asked. With dogs, e.g., you let them sniff something before sending them to search. And then you say "Search!"

"The details of our relations' with dolphins are our know-how. But take my word for it: dolphins can generalize what they can see. They primarily respond to the items which are distinguished from the natural background. Then they accomplish more specific tasks."

"And can they find lost treasures?"

"During the time of research using dolphins, we found and lifted from the bottom more than a ton of silver, amorphous, and other archeological wonders. You should agree that in addition to the scientific aspect, it is also very interesting from the economic viewpoint.

I suddenly got an idea: "And why haven't we used dolphins to look for the Loch Ness monster?" "

"No problem," the scientists respond. "As long as the monster is there. Dolphins are capable of staying in fresh water for a certain time without any harm to their health. Let them search. For certainty, we can also attach television cameras to them—we have also tried that too."

"Of course, these are exotic things. But if you are serious, there would be a lot of work for dolphins at oil and gas fields. And today, there are more and more of them further up North..."

"I understand. Would the dolphins freeze? No. They can dive very deep and they are well protected from hypothermia by a fat layer under their skin. Moreover, it is easy to train northern dolphins—the belugas."

Thus, Russian scientists have developed a unique training program—this is how we can tentatively refer to this process whereby any wild dolphin is turned in a nine-month period into an animal devoted to humans and capable of executing the most complicated tasks to find anything, even drowned persons. Their loyalty is so strong that when working in the open sea, the dolphins always return. No matter how they are being lured by their idol kin. This is a serious accomplishment on a world level. American forecasters thought that such problems could not be solved before 2020. There are other plans at the Moscow State University. They think there, in the form of a hypothesis at present, that it will be possible to work equally as successfully with other less "intelligent" animals. For example, with bats. We could certainly use their mastery of ultrasound. But...

The readers are probably already getting an idea that I will have to finish this report in a rather uneventful fashion. Research by the Moscow State University biologists is no longer being financed—the money has long run out. Both for salaries and for experiments. And the enthusiasm is running out too. It seems that no one cares about our lead. And about the fact that we proposed a method of underwater search which requires almost no physical expenditures and is environmentally clean and safe.

Dear businessman, you should really help the scientists. And you, oil and gas field workers, should pay careful attention. And give more help. And maybe, the government will also take an interest? It is worth it.

The scientists sigh "the problem, alas, is not simply in our salary or lost profit; we are embarrassed in front of our dolphin friends. We have no food to give to them..."

In the figure [not reproduced]: Buran is smiling and asking for food.

Prognostic Value of NBT Test in Icterohemorrhagic Leptospirosis

937C0080A Moscow KLINICHESKAYA LABORATORNAYA DIAGNOSTIKA in Russian No. 4, Jul-Aug 92 [manuscript submitted 29 Jul 91] pp 22-25

[Article by M. G. Avdeyeva, G. V. Melnik, V. V. Lebedev, M. G. Shubich, Kuban Medical Institute imeni Krasnaya Armiya, Krasnodar; UDC 616.98:579.834.115-037:616.155.034-078.3]

[Abstract] One modern technique for assessing the degree of expression of a pathological process in the body, severity of state, and efficacy of therapy is the determination of the functional state of the neutrophil leukocytes, specifically, from their ability to reduce nitroblue tetrazolium (the NBT test). Elevated values in the NBT test indicates, in most cases, the presence of a bacterial infection. Neutrophil activity is stimulated by latex or bacterial antigens to clarify the reserve capabilities of the neutrophil. In earlier work, the researchers studied the spontaneous NBT test in full-blown leptospirosis, identifying a considerable elevation of mean NBT-test values. Some patients, however, produced values that were below normal. In the work reported here, the researchers observed 148 individuals with icterohemorrhagic leptospirosis in order to study the possibility of using the NBT test to predict the severity of the course of the disease and the probability

of the development of complications. The indices for the spontaneous NBT test and the staphylococcus- stimulated NBT test were, in fact, found to be a function of severity of course and developing complications. Elevated values for the spontaneous NBT test were typical of a mild or medium severity or for a severe, but uncomplicated case. In patients with a severe form of the disease, but low spontaneous NBT-test values, the absence of staphylococcus stimulation served as a predictor of the development of life-threatening complications. Leptospirosis vaccine depressed NBT-test levels. Persistence of the depressive effect in convalescents indicated a high probability of the development of late complications. Figures 1, references 10: 7 Russian, 3 Western.

Investigation of Possibility of Selective Binding of HIV-1-Infected Cells Using Immunosorbents

947C0089C Moscow VESTNIK ROSSIYSKOY AKADEMII MEDITSINSKIKH NAUK in Russian No. 3, Mar 92 pp 54-56

[Article by Yu.M. Lopukhin, V.V. Pavlenko, D.V. Kulayev, V.S. Alekseychuk, E.V. Karamov, I.A. Rudneva, D.D. Petrunin, T.K. Lyukova, Scientific Research Institute of Physico-Chemical Medicine, Moscow; UDC 616.98:578.828.6]-092:612.017.1]-08:[616.153.962.4-097-089.816:615.246.2]-092.4

[Abstract] Reports of selective injury to CD4+ cells by HIV-1 (VICh) cells and the lack of selectivity in known AIDS treatment approaches which cannot ensure oriented removal of only infected mononuclear cells from the blood prompted an *in vitro* investigation into the possibility of selective binding of cells expressing HIV proteins from the infected culture with the help of immunosorbents. The C-3 silica gel with a mean radius of 48 A and a 200-250 μm mean grain size made in Gorkiy is used as the matrix, and the immunoglobulin fraction of the AIDS patient serum containing high titres of specific antibodies (1:3,000 in the indirect immunofluorescence reaction) is used as the ligand. The sorption binding of monocyte EVK/IRA/3 culture cells chronically infected with HIV-1 is summarized. Two approaches are used in the study: immobilization of antibodies to viral proteins expressed on the surface of affected cells on a rigid matrix and the use of nonspecific interactions of the model system cells with the sorbent cells. It is noted that no attempt was made to develop a superselective sorbent (selectivity is defined here as predominant sorption of HIV-infected cells compared to intact model system cells). The findings make it possible to speculate that one can develop a selective sorbent for predominant binding of HIV-infected cells by using an inert material, e.g., sepharose, as the matrix, and confirm the feasibility of immunosorption binding of cells expressing HIV proteins. The approach aimed at removing HIV proteins, intact virions, and circulating immune complexes from the blood or plasma with the help of immunosorbents is recognized as promising while the use of immunosorbents synthesized *in vivo* is thought to be debatable. The immunosorbents demonstrate a selectivity rate of 92% vs. 29% for the control group. Tables 1; references 9: 1 Russian, 8 Western.

Dietary ^{137}Cs and ^{90}Sr Intake by Gomel Oblast Population of Belarus in 1986-1989

947C0089D Moscow VESTNIK ROSSIYSKOY AKADEMII MEDITSINSKIKH NAUK in Russian No. 3, Mar 92 pp 57-59

[Article by A.A. Verbovikov, A.P. Yermalitskiy, Yu.A. Zhakov, V.N. Zinovich, V.A. Knizhnikov, E.V. Petukhova, Biophysics Institute, Moscow, and Gomel Oblast Sanitary and Epidemiological Oversight Station; UDC 613.2:546.36.02.137-546.42.02.90](476)-02:614.876(477)]

[Abstract] Dietary intake of the ^{137}Cs and ^{90}Sr radionuclides was evaluated on the basis of data which characterize the actual contamination of the foodstuff samples from ten inhabited localities in Gomel oblast and in Gomel and the prepared products sold to the population through the retail and public food service outlets. The dietary structure of the population determined by studying the family budgets carried out by the Gomel oblast statistical administration in 1985-1987 was used in analyses. The mean ^{137}Cs concentration in the food sold to the population by retail and public food service outlets in Gomel oblast, in Ci/kg, the structure of the diet used in computing the ^{137}Cs and ^{90}Sr dietary intake, the average daily ^{137}Cs and ^{90}Sr intake with basic foodstuffs in individual rayons of Gomel oblast in 1986-1989, the likely mean levels of daily dietary ^{137}Cs and ^{90}Sr intake (ignoring rejects), the actual mean levels of daily dietary ^{137}Cs and ^{90}Sr intake (allowing for rejects), and the ^{137}Cs and ^{90}Sr daily dietary intake of the population living in an area with a unit contamination density are summarized. The findings show that the food contamination levels decrease gradually with time (after the Chernobyl nuclear power plant accident). In particular, the ^{137}Cs intake decreased by threefold from 1986 to 1989. A rayon-by-rayon analysis reveals that Narovlyansk rayon which used to be the most contaminated with cesium is now in second place (a 206 to 60 10^{-10} Ci/day drop) while in Vetkovsk rayon, the ^{137}Cs level dropped from 185 to 62. Tables 6.

Biolakt Production in Kyrgyzstan

947C0029B Moscow MEDITSINSKAYA GAZETA in Russian 26 Mar 93 p 5

[Interview with prof, Dr Med Sci Anatoliy Aleksandrovich Ilin, by correspondent S. Lokteva; place and date of interview not given: "Biolakt With an Emblem of Quality"]

[Text] **What pediatrician doesn't know today what Biolakt is? This baby food product has long been popular among both physicians and mothers. But its recognition at the state level occurred only today. The results of 30 years of**

work were finally noted, and a group of Kyrgyz scientists was awarded the republic's 1992 State Prize in science and engineering on the anniversary of the Kyrgyz Republic's establishment "for creating children's dairy products of high biological value, for developing the production process, for their production and introduction into public health practice."

Today we talk with one of the recipients of the prize—professor, Doctor of Medical Sciences Anatoliy Aleksandrovich Ilin.

[Lokteva] To begin, in behalf of the newspaper I would like to congratulate you and your fellow workers—P. Fedorov, D. Kudayarov, V. Babich, V. Pavlinov, A. Knyazev, K. Sarzhanov and M. Kadyrov—on earning the award. And second, it would be interesting to hear from you that there is room for creative work in our long-suffering land.

[Ilin] Of course. The health of children, after all, is a special problem. It is directly associated with the society's standard of living. Unfortunately over 1 million children being born today in all of the former USSR are being raised on formula. The number of women experiencing insufficient lactation is increasing. There are also those who are unable to lactate at all. Therefore providing children with complete nutrition is an important social task. As for us, the medical scientists, our specific task in science is to make children's dairy formulas as close as possible in their biological indicators to mother's milk. This problem was in fact the initial motivation for creating the product we are discussing here.

[Lokteva] Let's remind the readers what Biolakt is.

[Ilin] A cultured milk product made from specially selected physiological strains of lactic acid bacteria possessing pronounced antibacterial and proteolytic properties, and low acidity. Proteins, fats and carbohydrates in milk are broken down in the course of the vital activities of these bacteria. Vitamins, enzymes, antibacterial substances and free amino acids accumulate in the food product. It is the presence of such an intricate complex of biologically active substance that raises the food value of Biolakt, and makes it resemble mother's milk. The product has a positive effect on nonspecific and specific immunity, and it normalizes gastrointestinal activity. Biolakt is also recommend for children over 1 year old, and as a therapeutic diet for patients with intestinal infections. It can be used for therapeutic purposes in the presence of gastritis, gastric ulcers, colitis and hepatocholecystitis.

[Lokteva] As I understand it, studies were conducted on Biolakt with the purpose of enriching it with vitamins and microelements lacking in mother's milk.

[Ilin] Yes, the choice of microelement compounds was important in this sense as well. Readily dissociating compounds were the most suitable from our point of view. Enriching the cultured milk product with lysozyme, which not only preserves mother's milk but is also compatible in qualitative composition with microflora of the child's intestine, is also useful.

[Lokteva] Are different varieties of Biolakt now being produced in this connection?

[Ilin] We have developed four varieties of the product. Adapted Biolakt and adapted Biolakt with lysozyme, intended for children in the first months of life; they are especially recommended for children who are weak and often sick. Plain Biolakt and enriched Biolakt are products for children in the second half-year of life. And in general, Biolakt products have therapeutic and preventive value when given to sick children over 1 year old. Especially when anemia, gastrointestinal and septic diseases, dysbacteriosis and lactase deficiency are present.

[Lokteva] Let's get back to the prize. Were you able to earn it just by doing scientific research?

[Ilin] Not only that. The most important thing was that we developed the technical conditions and parameters of producing the cultured milk product. For example we were able to establish that when copper sulfate and ascorbic acid are added to the solution simultaneously, the concentration of the latter in the food product decreases by 30 percent. On the other hand, were these substances to be added separately, after chelation of the copper with protein, vitamin C would be retained completely in the product. This is not to mention the fact that production factors affect the energy of acid formation, the mucus-forming ability of lactic acid bacteria, their reproduction, and antibiotic and proteolytic capacity.

[Lokteva] Was it these technological developments that permitted you to organize production?

[Ilin] All four varieties of Biolakt are now being produced in all cities and rayons of Kyrgyzstan, as well as 12 countries of the former USSR. But most importantly, a biological factory for industrial production of bacterial leaven used to make Biolakt in dairy shops, dairy kitchens and in the home has begun operating in Bishkek. Mass production of Biolakt will make it possible to reduce the shortage of baby foods at all levels. The cultured milk product can now be available to practically every mother in dry form. When necessary, it would be enough to transform the dry leaven into liquid form, according to the instructions of course, and then mix the latter with milk, after which this fabulous baby food is ready.

Today, the Bishkek biological factory, which has an easily remembered address—Chuy Prospekt, 304—can satisfy the demand of youngsters in all of the former Union. I am announcing this to you officially.

Hygienic Assessment of Actual Child Nutrition in Preschool Institution and Principles of its Correction in Area Affected by Chernobyl Nuclear Power Plant Accident

947C0121C Moscow GIGIYENA I SANITARIYA in Russian No. 6, Jun 93 pp 34-36

[Article by V.M. Krasnopevtsev (deceased), A.V. Istomin, T.I. Grishina, S.S. Chizhov, Moscow Hygiene Scientific Research Institute imeni F.F. Erisman and Plavsk Center of Sanitary and Epidemiological Oversight, Tula oblast; UDC 616-053.2-02:614.876]-085.874.2]

[Abstract] The importance of sound and balanced nutrition, especially under exposure to radionuclides which lower body resistance, prompted a hygienic evaluation of the actual nutrition at child care institutions and the necessary corrective measures related to the type of food. To this end, the actual nutrition was examined in the Plavsk rayon of Tula oblast in the framework of the 1990-1992 State Union-Republican Program of Urgent Measures in the aftermath of the Chernobyl nuclear power plant accident. A contingent of children was divided into two groups of 1-3 and 4-6 year old kids enrolled in a preschool institution. The preschool institution nutrition was examined by analyzing 100 menus using an analytical method with the help of tables. The characteristics of child nutrition rations based on the food intake ($M+/-m$) for proteins, fats, carbohydrates, caloric value, and protein:fat (animal vs. vegetable) ratio and the characteristics of daily rations of actual child nutrition for the content of principal nutrients and energy are summarized. This comprehensive hygienic assessment shows a lack of balance and a vitamin and mineral (especially calcium and iodine) deficiency. Based on the findings, balanced seven-day four-times-a-day rations for 1-3 and 4-6 year olds are specially developed for the areas affected by the Chernobyl nuclear power plant accident. Tables 2; references 8.

Gas Chromatographic Detection of Methyl Chlorocarbonate in Atmospheric Air

947C0121D Moscow GIGIYENA I SANITARIYA in Russian No. 6, Jun 93 pp 69-70

[Article by V.M. Pozhidayev, K.A. Pozhidayeva, L.A. Orlova, Bioavtomatika Scientific Research Center, Nizhniy Novgorod; UDC 614.72-074:543.544]

[Abstract] The large quantity of raw materials and ready products which enter the atmosphere in the form of dust and vapors during the manufacturing of drugs and their likely toxic effect on humans prompted the development of stringent exposure guidelines (OBUV) and necessitated regular monitoring of their concentration in the air near pharmaceutical industry enterprises. In particular, a method of determining the concentration of methyl ether of chloracetic acid—a colorless volatile flammable liquid with an irritating smell which is easily soluble in ethanol and ether—in the atmospheric air against the background of associated biologically active substances is developed. The detection method is based on using gas-liquid chromatography with a flame ionization detector whereby samples are taken with activated BAU carbon for subsequent thermal destruction and conversion to methyl chloride. The sampling and sample analysis procedures are outlined, and a chromatogram of the harmful substance separation in the air is plotted. The procedure has a detection threshold of 0.001 μg per 2 ml and and a lower measurement limit of 0.0015 mg/m^3 (in a 20 l sample). The measured concentration range is 0.0015-0.2 mg/m^3 with a measurement error of +/-17.5%. The procedure has been tested at industry enterprises and approved by the USSR Public Health Ministry. Figures 2.

On Use of Biotesting in Hygienic Assessment of Water Quality

947C0121F Moscow GIGIYENA I SANITARIYA in Russian No. 6, Jun 93 pp 75-76

[Article by M.V. Naboka, Ukrainian Scientific Research Institute of Environmental Hygiene and Toxicology of Chemical Substances imeni L.I. Medved, Kiev; UDC 614.717:628.16]-072.7]

[Abstract] The advantages and characteristic features of the use of biotesting for assessing the water quality are outlined, and the concept of hygienic significance which denotes toxicity to humans is introduced. For illustration, the effect of imported pesticides on *Daphnia magna* is investigated using draft GOST guidelines. The GOST approach is compared to the EPA and other procedures, and the acute toxic effect of the Maveric pesticide on *Daphnia magna* is summarized. The differences in the methods under study are discussed. The comparative analysis makes it possible to speculate that the methodological approaches to water quality assessment with the help of biotesting need further improvement but the findings are still insufficient for drawing definitive conclusions about the role of biotesting within the system of standard sanitary water quality control. Tables 1; references 7: 4 Russian, 3 Western.

Status of Enzymatic Antioxidant Protection System in Animals After Exposure to Radiation

947C0083B Minsk ZDRAVOOKHRANENIYE BELARUSI in Russian No. 8, Aug 93 pp 9-11

[Article by V.K. Kukhta, E.I. Oletskiy, L.P. Lisitsyna, T.V. Vasilkova, Z.I. Polyakova, I.V. Zakharenko, A.V. Polubinskiy, T.S. Morozkina, Biochemistry Department of the Minsk Medical Institute; UDC 616.014.482:612.015.1]

[Abstract] The finding that intensification of free radical oxidation in tissues is the principal damage mechanism in the effect of ionizing radiation on the organism prompted an investigation into the status of the enzymatic antioxidant protection system in the organism of

rats exposed to radioactive contamination for a long time. To this end, 28 male Vistar rats exposed to an external background radiation of 4 mR/h in Khoynik rayon of Gomel oblast for one month and 28 animals exposed to an external background radiation of 0.4 mR/h in Rechitsy rayon of Gomel oblast for five months are examined. The rats received an equivalent internal and external doses of 0.0141 and 2.52 rem, respectively, in the first group and 0.0021 and 1.44 rem in the second. The control group was exposed to an external background of 0.011-0.014 mR/h at the Minsk Medical School. The enzymatic antioxidant protection system indicators and the concentration of the lipid peroxidation products were compared to those of the control group. The experimental procedure is outlined. The reduced glutathion concentration and the glutathion peroxidase concentration in the liver and erythrocytes in group 2 rats are summarized. The study shows a marked increase in the lipid peroxidation product content in the irradiated animals; the superoxide dismutase activity in the animals exposed to a lower irradiation dose was much higher than that in the control group, attesting to stressed compensatory mechanisms which usually neutralize free oxygen radicals forming under the effect of ionizing radiation. Tables 1; references 7: 4 Russian, 3 Western.

Carotene and Antioxidant Vitamin Concentration in Organism of Animals Kept on Radionuclide-Contaminated Territory

947C0083C Minsk ZDRAVOOKHRANENIYE BELARUSI in Russian No. 8, Aug 93 pp 11-15

[Article by T.S. Morozkina, A.S. Zakharevskiy, V.N. Sukolinskiy, N.I. Gronskaya, Zh.A. Rutkovskaya, N.B. Yermakov, O.V. Stoma, Biochemistry and Pharmacology Departments of the Minsk Medical Institute, Belarussian Scientific Research Institute of Cancer and Medical Radiology, and Radiobiology Institute at the Belarussian Academy of Sciences; UDC 577.391:621.386.86]

[Abstract] The decisive role played by carotenes and vitamins E, C, and A in enabling the tissues to resist the development of radiation-induced free radical damage prompted a study of the concentration of vitamins E and A and ubiquinone, ascorbic, dehydroascorbic, and diketogulonic acids, β-carotenes, lipid peroxidation products, dien conjugates, and malonic dialdehyde in blood and plasma and liver mitochondria of 28 rats kept for five months at permanent monitoring stations (reference points) in Rechitsy rayon of Gomel oblast. The radioactive cesium concentration at these points was 1.041+/-0.043 kBq/kg, and the animal nutrition ration consisted mostly of cereals (oats) with a specific radioactivity of 0.28 kBq/kg for cesium. The ascorbic, dehydroascorbic, and diketogulonic acid concentration in the blood plasma and liver of rats kept in the radioactive contamination zone (group 1), the β-carotene and antioxidant vitamin concentration (ascorbic, dehydroascorbic, and diketogulonic acid and vitamins E and A) in the rat liver (groups 2 and 3), and the concentration of the lipid peroxidation products in the blood plasma and liver mitochondria of the test animals are summarized. All indicators were measured in group 1 (seven rats) immediately after the rats returned from the exposure zone; the remaining two groups were switched to the vivarium ration; one half (group 2) was injected with the antioxidant vitamin complex ten times on alternating days; the remaining 10 rats (group 3) received no treatment. The findings show that the ascorbic acid concentration in the blood plasma and especially liver in group 1 is depressed while vitamin E concentration in group one was lower than that of the control group by more than twofold. The hypovitaminosis state was corrected by the AK preparation—an antioxidant complex of vitamins E, A, and C. This corrective action not only normalizes the β-carotene, tocopherol, ascorbate, and retinol levels in the blood and liver of test animals but also lowers the rate of the free radical oxidation processes by decreasing the peroxidation product concentration, thus helping to increase the animals' radiological resistance. Tables 3; references 11: 8 Russian, 3 Western.

Hemodynamics in Children With Pyelonephritis Living in Radionuclide Contaminated Regions

947C0083A Minsk ZDRAVOOKHRANENIYE BELARUSI in Russian No. 8, Aug 93 pp 6-9

[Article by A.M. Chichko, Department of Children's Diseases No. 1 at the Minsk Medical Institute and Children's Clinical Hospital No. 2; UDC 616.61-002.3-053.2:612.13:614.73]

[Abstract] The hemodynamics of 108 children aged 6-14 (87 boys and 21 girls) with acute and chronic pyelonephritis—the most frequent urinary system disease in children with a tendency toward persistent relapses whose principal pathogenetic mechanisms are related to infection, chronic intoxication, and other factors aggravated by the unfavorable consequences of the Chernobyl nuclear power plant accident—including 76 kids from the regions contaminated with radionuclides are examined. In particular, the characteristic features of hemodynamics in children permanently residing in the contaminated rayons of Gomel and Mogilev oblasts are investigated. Tentative data on the radiation burden were based on the information about the radionuclide contamination of the territory obtained by the sanitary-epidemiological station, γ-background indicators, and the results of medical examinations. A higher incidence of hypotension in children living in the regions with a considerable level of contamination with a predominance of hyperkinetic hemodynamics are recorded, especially at considerable ^{137}Cs contamination levels of 5-15 Ci/km^2, and a higher incidence of hypersympathicotonia and sympathicotonia are identified. A hemodynamics analysis reveals no statistically significant differences in the arterial pressure indicators in the groups under study but a significant increase in the volumetric rate indicators of blood expulsion by the left ventricle and cardiac index in children with the disease vs. healthy kids. Yet

thee indicators turned out to have no statistical correlation with the contamination level. The findings indicate a considerable disruption of vegetative regulatory activity of the cardiovascular system. Figures 1; tables 1; references 5.

PHARMACOLOGY AND PHYSIOLOGY

Role of Enkephalins in Antiarrhythmic Adaptation Effect Mechanism in Acute Myocardial Ischemia

947C0089A Moscow VESTNIK ROSSIYSKOY AKADEMII MEDITSINSKIKH NAUK in Russian No. 3, Mar 92 pp 5-8

[Article by Yu.B. Lishmanov, L.M. Maslov, I.G. Khaliulin, N.A. Barbarash, Scientific Research Institute of Cardiology at the Tomsk Scientific Center of the Academy of Medical Sciences; UDC 616.127-005.4-036.11-092.9-06:[616.12-008.318-084:616-092.19-021.7]

[Abstract] Reports about the possibility of preventing stress-related myocardial injury and cardiac rhythm disruptions in acute myocardial ischemia (OIM) by preliminary adaptation with the help of short mobilizations, brief hypoxia, and physical stress and enkephalin's known ability substantially to affect the vegetative myocardial innervation, making it possible to speculate that cyclical nucleotides play a role in realizing antiarrhythmic effects of opioid peptides (OP), prompted an evaluation of the possibility that cardial enkephalins may participate in the mechanisms of preventing arrhythmia in adapted animals. The experiment to study antiarrhythmic adaptation effect was carried out on 60 200-250 g Vistar male rats which were divided into four groups: intact, adapted to cold, adapted to physical stress through swimming, and adapted to the combined effect of cold and physical stress. The experimental procedure is outlined. The experiment shows that at a -11°C temperature, animals not adapted to cold die after 5-7 h while the adapted ones survive for at least 16 h. The adapted animals also had 1.5 times more fat. The animals not adapted to physical stress swim with a load of 10% of their body mass for no more than 10 min while the adapted animals swim for at least 25 min. Adaptation to combined physical stress and cold facilitated a reliable twofold decrease in mortality in subsequent acute myocardial ischemia and a decrease in the ventricular fibrillation rate and duration. The effect of adaptation and acute myocardial ischemia on the enkephalin concentration in the myocardium and the effect of adaptation and acute myocardial ischemia on the cyclical nucleotide concentration in the myocardium ($M+/-m$) is summarized. The findings demonstrate that adaptation to the combined exposure to cold and physical stress is the most effective in developing the endogenic opioid system stimulation and preventing arrhythmia in acute myocardial ischemia as well as lowering the experimental animal mortality. The study also reveals that intravenous administration of dalargin (enkephalin) before the coronary occlusion inhibits an increase in the cAMP concentration induced by acute myocardial ischemia, probably due to activating presynaptic opiate receptors. A limitation of the adrenergic effect on the myocardium in acute myocardial ischemia facilitates a decrease in the rate of cardiac arrhythmia. The findings attest to the fact that endogenic cardial enkephalins may play a significant role in the mechanism of antiarrhythmic effect of adaptation in acute myocardial ischemia; this effect is attributed to a decrease in the adrenergic influence on the heart and serves as an indirect evidence of a decrease in the sympathetic effect of the peptide on the heart. Tables 2; references 20: 11 Russian, 9 Western.

Role of Specific Brain Peptide Factors in Pathogenesis and Compensation for Neurological Disorders and Their Use for Nervous Disease Treatment

947C0089B Moscow VESTNIK ROSSIYSKOY AKADEMII MEDITSINSKIKH NAUK in Russian No. 3, Mar 92 pp 34-37

[Article by G.A. Vartanyan, M.V. Neuymina, V.I. Golovkin, G.N. Bisaga, Institute of Experimental Medicine at the Academy of Medical Sciences and Military Medical Academy imeni S.M. Kirov, St. Petersburg; UDC 616.8-009.2-02:616.831-001-092.9-085]

[Abstract] The difficulty of correcting stable motor function disorders due to the central motor system impairment of varying origin and the scarcity of data on the pathogenic mechanisms of these disorders prompted an extended research effort aimed at establishing the molecular-chemical mechanisms which underlie the so-called pyramid syndrome conducted at the Physiology Department of the I.P. Pavlov Institute. It established the specific neurohumoral factors capable, if injected to intact animals, of inducing motor disorders similar to those of the donor. There factors became known that the postural asymmetry factors (FPA) present in the cerebrospinal fluid (TsSZh). Special studies reveal that the postural asymmetry factor activity is blocked by a high-molecular peptide factor referred to as the inactivation factor (FI). The role of the specific brain peptide factors in the pathogenesis of, and compensation for, neurological disorders and the outlook for using them in the nervous disease treatment are investigated, and a new method is proposed on the basis of the experimental and theoretical work of Institute personnel (which have been issued patent No. 365 on 11 May 89 by the State Committee on Inventions and Discoveries). The method is based on using the donor liquor from patients who have convalesced well. To this end, the clinical effectiveness of the proposed method was examined using a contingent of patients with rather severe disorders; the cerebrospinal fluid of patients with a good recovery history was used as the donor liquor. The conclusion is drawn that liquor therapy is a promising treatment method for some disorders and that the hypothesis that the ligands search for the liquor of own receptors can be

confirmed. It is noted that basic research into the molecular-chemical mechanisms of pathogenetic and compensatory brain processes make it possible not only to widen the scope of theoretical notions in the field of neuropathology but also to use them effectively in clinical practices. Tables 1; references 15.

LASER AND NONIONIZING RADIATION

Possibilities of Using Fiber Optic Luminescent Light Sources in Medical and Biological Research

947C0051A Moscow MEDITSINSKAYA TEKHNIKA in Russian No. 2, Mar-Apr 93 pp 13-14

[Article by V.A. Monich, I.V. Krivosheina, S.L. Malinovskaya, K.N. Kontorshchikova, Nizhniy Novgorod Medical Institute; UDC 615.849.19.03]

[Abstract] The emergence of low-power medical lasers and the resulting uses of such lasers on biological tissues as well reports that the use of noncoherent light sources and lasers in clinical practices leads to virtually indistinguishable results prompted renewed interest in developing light treatment devices using polymer optical fibers, especially since in most cases, the clinics do not have the facilities for retuning the laser radiation wavelength to match its spectrum with the resonant absorption lines of biologically significant molecules. The optical fiber will be able not only to transmit radiation bounded by the fiber end aperture but also the light generated by photoluminescence of the impurities. The structure of a two-layer optical fiber containing luminescing impurities and a block diagram of the fiber optic luminescent device are cited, and the design and operating principles of this low-intensity fiber optic luminescent device designed on the basis of the above characteristics are described in detail. The operating principle makes it possible to combine the function of injecting light into thin fibers and isolating spectral radiation bands which are most effective in given procedures. The device's ability to generate pulse radiation greatly increases the strength of the postoperative sutures; a 40 Hz frequency is optimal, and red light (600-680 nm) is the most efficient. Experiments with animals and donor blood demonstrates that monochromated light has a favorable effect on skin tissue regeneration. Figures 3; references 9.

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